DOWN " CORONATION SCOT."

Ascending Shap at nearly 70 m.p.h. on a gradient of 1 in 146 before the final climb of 4 miles on a 1 in 75 gradient. The normal weight behind the tender is 262 tons.

BRITISH RAILWAYS TO-DAY

by

K. G. FENELON, M.A., PH.D.

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TO

E. R.

PREFACE

For some seventy years or so, British railways enjoyed a practical though state-regulated monopoly of inland transport, but during the past twenty years this monopoly has been steadily undermined by the development of road transport. At first the railway companies were slow to realize the significance of the new competition, but eventually they were forced to reorganize their services and to introduce many new facilities, some of which were dependent on the provision of road services of their own. In the difficult years of industrial transition which have followed the Great War, many other factors have complicated the problems of the railways.

In the pages that follow, the author has attempted to provide a survey of modern railway practice, and has devoted particular attention to recent developments and new facilities. He hopes that the book may provide sufficient material for the informed discussion of railway problems, and, with this end in view, reference has been made to various viewpoints on a number of controversial matters, while some comparisons have been drawn between British conditions or practice and those of foreign countries.

Transport to-day is a vital factor in the welfare of the community, and it is of the first importance, on the one hand, that the railway companies should appreciate the requirements and problems of traders and the travelling public, and on the other hand, that railway users should be well informed about the problems of the companies.

Large organizations tend to be regarded as impersonal; they are especially liable to over-rigidity and conservatism; and they may become over-centralized and irresponsive to local needs or local criticisms. The task facing railway management to-day is to break down these tendencies, and to provide facilities which will meet the requirements of a

changing economy. It is, however, only fair to state, as recorded in the following pages, that already considerable success has been achieved in these directions. During the past eleven years, for example, the companies have expended £75,000,000 on capital account; over £184,000,000 on renewals; and numerous large-scale technical improvements have been introduced. Further, it would appear that now the transport systems of the country are on the threshold of a new era as a result of the agreements reached between road and rail.

Though the author alone is entirely responsible for all opinions expressed in this book, and for any errors there may be, he is indebted to Lord Stamp, G.C.B., G.B.E., LL.D. (Chairman and President, L.M.S.R.), for valuable suggestions for the improvement of certain sections; to Sir Harold Hartley (Vice-President, L.M.S.R.) for generous assistance in obtaining material; to Sir William Wood (Vice-President, L.M.S.R.) for useful criticisms and suggestions; to Mr. G. Szlumper, C.B.E. (General Manager, S.R.), and Mr. R. Bell, C.B.E. (Assistant General Manager, L.N.E.R.), for help in obtaining material.

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BRITISH RAILWAYS TO-DAY

CHAPTER I

RETROSPECT

PROBABLY no other industry in Great Britain bears so strong an impress of the past as do the railways. In Britain, the railways were at first developed haphazard to meet local needs, and even at a later period, when the main trunk lines were being built, little or no attempt was made to build them on any definite or systematic plan; on the contrary, Parliament encouraged the construction of competitive routes between important cities. Hence to-day, British railways, despite many successive amalgamations, still penetrate into each other's areas, and until recent traffic-pooling agreements were effected, competed for traffic with each other.

Physical characteristics have been determined by standards set by early constructions. Thus the limits imposed by tunnels and bridges on the permissible height and width of vehicles and locomotives (known as the "loading gauge") are less generous than those common in other countries which, profiting from the experience of

British railways, built to more generous proportions. A striking difference between British and foreign railway practice is that on British railways almost every second wagon is privately owned, whereas abroad wagons, except those of an expensive, special type, are almost invariably owned by the railway itself. The British trader's wagon is a relic of the earliest days of public railways ; but though the system involves the railway companies in additional operating costs, the numerous vested interests concerned are strongly opposed to any change.

From the past, also, is derived the strict, detailed control exercised by the State over the railways, which has been handed down from the days when the railways had a virtual monopoly of inland transport, and the State was determined to prevent any danger of the community being exploited.

Early Railways.—The first British railways had their origin in the need of providing a more efficient mode of transport for coal than the roads, which were then in an incredibly bad state of repair. These early railways, along which wagons were propelled by horses or by gravity, consisted of wooden rails laid on wooden sleepers. Railways of this type were well established on Tyneside in the seventeenth century, and by the following century their use had spread to nearly all the colliery areas.

It would seem that the wagons were provided with flanged wheels to keep them on the track, and that the flanged rail which enabled ordinary

carts to be used was a later introduction, despite popular opinion to the contrary.[1]

Some of the early railway lines were surprisingly like the level and specially prepared track of a modern railway. Thus the Tanfield Colliery wagon-way in County Durham, constructed in the eighteenth century, was designed to avoid gradients, and had extensive embankments, long cuttings, and several bridges. One of these embankments still serves as part of the Tanfield branch of the L.N.E.R., and is probably the oldest railway embankment now in use.

Development of the Permanent Way.—As time went on successive improvements were introduced into the technique of railway construction. Wooden rails were faced with iron plates—incidentally this gives the derivation of the modern "platelayer," and in turn these gave way to cast-iron rails, and subsequently in the early nineteenth century to wrought-iron rails, until finally, about 1870, the steel rail was introduced. The latest development—though that is of our own day—has been in the direction of utilizing longer rails; now the 90-foot rail is superseding the 60-foot rail, and experiments are being carried out with 120-foot rails. On some railway systems abroad long lengths of rail are being welded together so as to avoid joints, and in Great Britain welded rails, or rails with a patented joint, such as the Brogden lapped joint, are being employed in tunnels and across bridges for the purpose of minimizing noise, jolting, and wear.

[1] C. E. Lee, *The Evolution of Railways.*

On some of the early railways stone blocks were used instead of wooden sleepers to support the track, as, for example, on the Leicester and Swannington Railway (opened 1832), but eventually iron chairs and wooden sleepers laid on stone ballast became universal in this country. Experience has shown that this is the best method of spreading the pressure (which may be as much as 20 tons a square inch) from the small area where the wheels and tires are in contact with the rail to the comparatively soft earth which ultimately bears the weight of a 600-ton express train. Ballast, which consists of hard, angular-broken stones, serves to distribute the weight over a wide area, and holds the sleepers in line and at an even level. The depth of ballast required depends on the nature of the surrounding soil, but it is important that the ballast should be porous so that good drainage can be effected, as otherwise the soil below might become too soft. Considerable research has been undertaken during the last few years into problems connected with ballasting. Especially effective are the packing of ballast by carefully-measured shovels, and super-elevation on curves to the extent of $5\frac{1}{2}$ inches for a half-mile curve for speeds of 60 m.p.h. In the U.S.A., to carry the heavier locomotives and trains common in that country, 3,000 sleepers are laid to the mile of track, and deep ballasting has proved successful on lines carrying very fast trains. The weight of a standard steel rail to-day as employed by the British main line companies is 95 lb. a yard,

PROGRESS ON THE SOUTHERN RAILWAY.

(*a*) Buffet car on the Littlehampton, Bognor Regis, and Chichester electric route.
(*b*) Booking hall of a suburban station.

each chair weighs 46 lb., and 2,112 sleepers are laid in a mile.

Public Railways.—To revert to the early railways, the public had no access to these as they were built for the exclusive use of their owners. The first railways open to traders in general were constructed in the eighteenth century by canal companies to act as feeders to their waterways. These lines were on an entirely different footing from the colliery railways, as on them any one could run a wagon or cart on paying the appropriate toll. They were constructed as flanged plateways with a flange projecting on the inside of the track, above the rail level, so that ordinary carts could be accommodated.

The first public railway company, independent of canal or colliery, was the Surrey Iron Railway, which obtained its Act of Parliament in 1801, and was opened in 1803. This line, which ran from Croydon to Wandsworth, was built by William Jessop, with double tracks of cast-iron L-shaped plates laid on stone blocks. The general public could utilize the flanged track with their own horse-drawn vehicles on paying tolls which varied from 1d. to 3d. per ton-mile.

The next important step towards the evolution of the modern railway was the application of steam as a motive power. Richard Trevithick—the "father of the locomotive engine"—constructed a practical, though imperfect, locomotive in 1804, which was used on a colliery line at Pen-y-daren. William Blenkinsop, in 1812, introduced a locomotive at Middleton Colliery,

near Leeds, but as he believed that smooth driving wheels would slip on the rails, he invented a cog-wheel and rack-rail device to prevent slipping. A little later, locomotives were also built elsewhere, utilizing ingenious but unnecessary devices to prevent slipping, such as that of Chapman in 1812, whose locomotive hauled itself along by means of a chain laid between the rails, or the " walking engine," which, though never built, was designed to be propelled by mechanical legs pushing on the ground behind it. In 1813, William Hedley at Wylam Colliery, and in 1815, George Stephenson at Killingworth Colliery, again demonstrated that there was no difficulty in obtaining sufficient adhesion between smooth wheels and smooth rails on level tracks.

All these early locomotives were used at collieries, and though they moved slowly, they sufficed for the purpose.

In 1825, the Stockton and Darlington Railway was opened, and it has the distinction of being the first public railway to utilize a steam locomotive. The opening of this line was a landmark in the history of railways, and it has been well described as the first modern railway. In it all the features of the transition from the old railways to their modern counterpart were exemplified. On the advice of George Stephenson, whom they had appointed as their engineer, the projectors, after some hesitation, decided to use iron rails and steam locomotives. On certain sections, however, cable traction was utilized and, on payment of the appropriate tolls, any one was

free to use the railway with horse-drawn vehicles of their own. Passengers were carried in horse-drawn carriages by independent coach proprietors when the line was not in use for goods haulage. It was soon found that this practice was unsuitable, so in 1833 the company bought out the coach proprietors, and in the following year introduced steam locomotives to haul their passenger trains.

The Stockton and Darlington railway demonstrated the impracticability of common use by private hauliers when steam power was employed.

The distinction of being the first railway regularly to convey passengers in steam-hauled trains belongs, however, not to the Stockton and Darlington Railway, but to the Canterbury and Whitstable Railway opened on May 3, 1830. More important, however, was the opening of the Liverpool and Manchester Railway on September 15, 1830. This is the second outstanding landmark in the early history of railways, as it definitely demonstrated the advantage of the steam locomotive over other forms of traction and proved the superiority of the railway over canals and roads. In 1829, a trial was held at Rainhill to discover the best locomotive, and this was easily won by the *Rocket*, constructed by George Stephenson and Henry Booth. The principle of a tubular boiler (in place of the single flue previously used) combined with a forced draught from the exhaust steam adopted in this locomotive still remain the basic features of the

steam locomotive. Subsequent improvements have been in the nature of refinements enabling engines to haul heavier trains at higher speeds.

The Liverpool and Manchester Railway showed that rail transport was especially suitable for passenger traffic. Indeed, from 1830 to 1850 passenger traffic yielded the greater bulk of railway revenues, though the companies had been primarily inaugurated to carry coal and other minerals.

The success of the Liverpool and Manchester Railway led to the immediate construction of numerous other railways, but these were all built to serve local needs, and were not planned in relation to one another. The first main line railway—the London and Birmingham Railway—was opened in 1838, and in that year also the G.W.R., the L. and S.W.R., the Eastern Counties Railway, and other railways were under construction. Little attempt was being made to standardize the various undertakings, though by that time it should have been clear that railways were national, not local in their possibilities. Even the gauge—or distance between the rails—was not uniform. Stephenson had adopted a 4 ft. 8 in. gauge—incidentally not the now standard gauge of 4 ft. 8½ in.—but there was a great diversity of gauge among early railways. The early wagon-ways in N.E. England varied from 4 ft. to 5 ft; the Edinburgh and Dalkeith was 4 ft. 6 in., and the Eastern Counties 5 ft. Isambard Brunel was a keen advocate of the broad gauge, and he constructed the G.W.R.

to a gauge of 7 ft. Not until 1846 did the Government make a belated attempt to secure uniformity of gauge by prescribing a uniform gauge of 4 ft. 8½ in. for all new railways, except in the West of England, where the 7 ft. gauge was allowed to continue. Eventually, however, the G.W.R. came into line, and the last broad gauge train was run in 1892 ; thus ending fifty-four years of the 7-ft. gauge.

Amalgamation was found at an early date to be essential to secure operating efficiency, to obtain financial strength, and to enable the companies to provide through services. Between the years 1844 and 1847 amalgamation proceeded rapidly, largely as a result of the influence of George Hudson, whose widespread activities earned him the name of " The Railway King " or " The Railway Napoleon." Hudson's outstanding achievements were the creation of the Midland Railway in 1844 and the L.N.W.R. in 1846. Though eventually driven from power and influence, as his financial methods were open to suspicion, Hudson did much to promote the greater efficiency of British railways by building up extensive systems out of a chaos of small, competing companies.

During this period in which amalgamations were being effected, there was also a spate of railway constructions, which culminated in the " Railway Mania " of 1844-46 when railways were planned in all parts of the country, even where there was little potential traffic to justify their construction. In these years, the main lines

of communication as we know them to-day took shape. Until the boom suddenly collapsed in 1847 there was wild speculation in railway shares in which all classes of the community participated.

Opposition to the Railways.—It must not be imagined that the then new-fangled railways were universally welcomed; on the contrary, practically all the early railways had to fight hard to obtain powers from Parliament to construct their systems. There was strong opposition from vested interests, such as canals or turnpike roads, or from landlords who feared that the amenities of their country houses or their fox coverts might be adversely affected. An opportunity for effective opposition was provided by the necessity under which the railways laboured of securing legal privileges from Parliament, since it was essential that they should have powers to buy land under compulsion, to cross public roads, or to obtain other easements.

Land had to be bought at fancy prices, or else the route had to be diverted to avoid mansion-houses or fox coverts, while lavish bribes had to be given to buy off the opposition of vested interests. The railway companies were forced to purchase numerous canals, and eventually they became the owners of some 1,051 miles of canal, or roughly a third of the total canal mileage. It is often asserted that the railways bought up canals in order to strangle them. This is not, however, in accord with historical fact, though it is no doubt true that the railways, once

having gained possession of a canal, did little to improve it, since they regarded water transport as out-of-date. The railways were placed under a statutory obligation to maintain their waterways in a reasonable state of repair, and this they have done, though they have not been willing to spend money on improvements. Railway ownership of certain canals has probably militated against the improvement of the inland waterway system as a whole, because the railway canals often constitute important links in through routes. It has been suggested, therefore, that the railway-owned canals should be transferred at a valuation to inland waterway trusts set up by the State for the betterment of canal transport. But this is another matter.

The extortion of excessive compensation by vested interests, and the cost of overcoming opposition, considerably inflated the amount of capital required to construct the railways. British railways on this account, though also in part owing to the high standards of construction adopted, are the most highly capitalized per mile of route in the world. In other countries the State, if it did not itself build the railways, protected the companies against exploitation, or indeed granted them favours, such as the free land gifted in Canada by the Government to encourage the construction of railroads. Abroad, governments generally assisted actively in the promotion and construction of railways; in Britain the Government was dubious of the power which the railways might attain, and was unduly favour-

able to the claims of landowners and vested interests. Foreign railways, moreover, being built at a later date than the British systems, were able to profit by their experience and were not trammelled by survivals from early conditions and regulations. In any comparison of British with foreign railways, these facts have to be taken into account.

Railway Legislation.—Every British railway has been incorporated by a special Act of Parliament, and to-day the powers of the large amalgamated companies are derived from the original powers of something like one thousand small companies, each inaugurated by a special Act of its own. Such legal powers were essential in the days before the Companies' Acts facilitated the formation of public limited companies; but even if a railway could have been formed as are other limited liability companies to-day, it would have been necessary to secure legal powers, as otherwise the whole scheme might have been held up by recalcitrant landlords or local authorities. A railway company can only do those things which are expressly permitted to it, either by general railway legislation, or by its own Private Acts. To modify its powers, or to secure additional powers, it must obtain further special Acts. It was for this reason, for example, that the four big groups had to obtain special Acts in 1928 to enable them to operate road transport services, or to invest in road transport undertakings. Almost every year, a private bill requires to be promoted by each of the railway companies to

obtain consent to easements, alterations to sewers and improvements affecting land.

When Parliament granted powers to the companies, it generally also imposed definite obligations on them; sometimes specific interests have been protected, *e.g.* certain towns have obtained special concessions regarding rates and fares; or special classes of persons or goods have obtained privileges, *e.g.* workmen's fares or the carriage of mails and troops. From the earliest days of the railways, Parliament has regulated the charges which may be made. Thus the Surrey Iron Railway was restricted as to the maximum tolls it might charge, and a classification like those of the canals and turnpike roads was imposed on it.

Apart from Private Act regulations, which apply to specific companies, the State has imposed many restrictions and obligations on railways in general. The problem of Government control of railways bulked very large in the nineteenth century, and successive Governments hesitated between their disinclination to compromise their *laissez-faire* tradition, and their fear of a transport monopoly, which they believed might become dangerous to the welfare of traders and the community generally. The aim of the Government was to break down monopoly by encouraging the building of competitive lines, or by preventing amalgamation. Then, when the economic trend towards amalgamation was seen to be almost inevitable, protection of the community was sought in imposing obligations to provide reasonable services, or in prohibiting

any undue preference to any one trader over another, or in limiting the charges which might be made by the companies.

Government Committee after Committee, and Royal Commission after Commission, were set up to investigate and report on the railway problem. Following the recommendations of these bodies, numerous Acts were passed to regulate the railways, to hinder further amalgamations, or otherwise to curb the powers of the companies. Though many of these Acts were ineffective, Parliament gradually obtained a controlling and restrictive power over the railways, which culminated in the Railway and Canal Traffic Act of 1888. This Act introduced a statutory classification for goods traffic and fixed maximum rates for all classes of merchandise, beyond which the companies were forbidden to charge.

At the end of the nineteenth century the general position under the various Acts was that railways were common carriers, bound to accept practically every kind of traffic offered to them ; they could not pick and choose their traffic, selecting the remunerative and rejecting the unremunerative, but had to carry for all and sundry. They had also to provide facilities for the conveyance of many special kinds of traffic ; they were forbidden to grant any undue preference or to enter into unfair or unreasonable contracts. Tables of fares had to be posted in stations, where they were required also to keep rate books available for public inspection, show-

ing all the rates and charges in operation. Special taxes were levied on them; they were responsible for the maintenance of roads over their bridges, and finally, railway working was regulated even in details, such as in respect to the height and width of platforms, and the provision of clocks at stations.

Chapter II

STATE CONTROL

During the war years, and for a short time thereafter, the railways were in the possession of the Government. Their net revenues became the property of the Government, but in compensation they received amounts corresponding to those earned in 1913, together with interest on new capital expenditure. Maintenance and repairs were reduced to a minimum during the war, and these arrears had to be made good before the railways could hope to recover their pre-war efficiency. Periodical payments had been made for "arrears of maintenance" representing the estimated arrears of work at 1913 prices, plus 15 per cent. for the rise in prices, and it was agreed that the 15 per cent. would be adjusted to the actual increase when the work was made good. These adjustments and other claims in respect of restoration of stocks of stores, consequential damages, and other matters were ultimately settled by the payment of a sum of £60,000,000. This may appear to be a large sum, but as it was only equivalent to between three and four months' gross revenue at that time, the railways cannot be accused of having profiteered at their country's expense.

In 1921 the opportunity was taken by the Government on the return of the railways to ordinary commercial management to readjust the relations of the railways to one another, to their employees and customers, and to the State. The new policies were embodied in the Railways Act, 1921; a far-reaching and comprehensive measure which radically transformed the whole position of the railways.

Railway Grouping.—Under Part I. of this Act, some 120 different railway companies were combined into one or other of four big groups; the actual amalgamations being effected in 1923. Grouping was compulsory; and thus the Act marked a new stage in the attitude of the Government to the railways, because before 1921 the State had strenuously opposed amalgamation. Great economies were anticipated from the grouping, but as time has shown many of the estimates made in 1921 were too optimistic. Grouping involved difficult problems of reorganization, and necessitated the realignment of former competitive interests. It required a reorientation of the outlook of officials and staff, and the recasting of traffic working and other operating facilities. In any case, savings could only gradually be effected, as compensation had to be given for loss of office, while stations, depots and junctions had to be adapted to the new conditions. Even now, after some eighteen years, this latter work has not been completed, and innumerable examples from up and down the country could be given of duplicated stations,

nests of sidings, or goods depots where one modern set of facilities would better serve the companies and the public.

The main difficulty in making such improvements lies in the fact that they necessitate additional capital expenditure, and the low rate of return on present capital makes it difficult to raise new capital. Also, a better system of traffic pooling than that at present in operation would probably be necessary to encourage such expenditure where more than one of the groups is involved.

Grouping did not by any means eliminate competition between the companies. It was impossible to effect a geographical redistribution, as the British railway systems had grown up haphazard and penetrated into each other's areas, either directly, or indirectly through running powers. Many roundabout routes existed, and indeed the Act allowed not only old circuitous routes to come under the shorter distance rule for charging purposes, but permitted new ones to be approved.

Somewhat illogically, the Act did not permit the companies to allocate or pool traffic among themselves without the express consent of the Minister of Transport. In 1931, however, the Royal Commission on Transport recommended the pooling of traffic receipts and the interweaving of time-tables on competitive routes. In 1932 and 1933 the Minister of Transport sanctioned various schemes of traffic pooling among three of the groups on competitive routes. Public

opinion by this time had come to regard traffic pooling more favourably, though previously opinion had run strongly against such schemes on the ground that they were monopolistic in character. Even still, there are people who view traffic pooling with disfavour, as they believe that a choice of routes stimulates the railways to give a better service and to be more attentive to the needs of the public. The railway companies, on the other hand, claim that traffic pooling enables them to provide better services, to dovetail time-tables, and to introduce inter-availability of facilities. Inter-availability is in itself a great boon to the traveller, as it gives a greater choice of times and routes, and tends to popularize rail traffic by removing petty restrictions.

Pooling gives scope to the railways to eliminate unnecessary expenditure on duplicated facilities, to reduce canvassing and advertising expenses, and to effect economies through the combination of station and depot facilities. Intensified road competition has offset recently some of these possible economies, and canvassing staffs have been substantially augmented.

Another stage in the development of pooling was achieved as a result of the London Passenger Transport Act, 1933, which provided for a pooling of receipts between the London Passenger Transport Board and the suburban routes of the four main line companies.

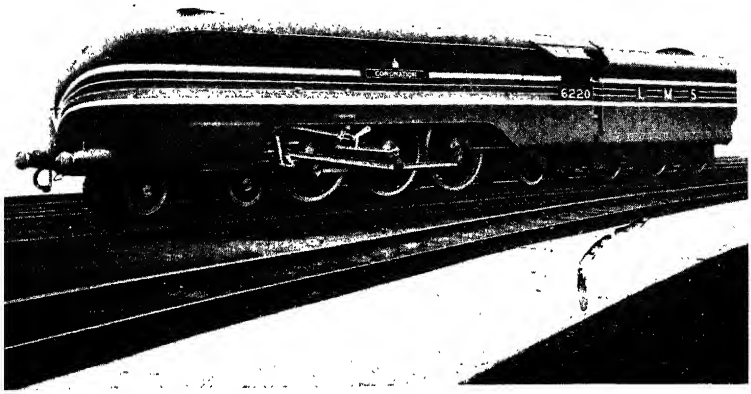
There are some who hold that the next logical step would be the formation of one large group

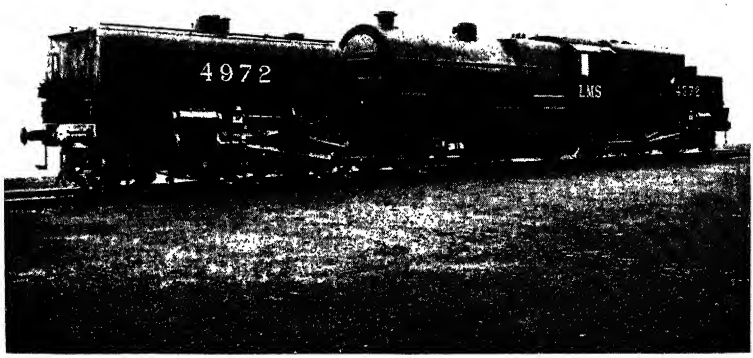
for the whole country. There is no doubt that this would enable certain economies to be realized, though it should not be expected that these economies could be achieved immediately. It would enable practically all the work of the Railway Clearing House to be eliminated, staffs could be amalgamated, duplicated facilities avoided, locomotives and coaching stock could be pooled and used to the greatest advantage, repair depots and workshops might be centralized, and numerous other economies realized. On the other hand, the probable economies are often exaggerated, and there would be great difficulties in the administration and organization of such a huge concern, especially in a country of dense traffic and diversified industrial regions like Great Britain. Even as things are, there have been difficulties in so organizing the present groups that local officials may retain sufficient power and authority to deal with local problems. Centralization would also involve social repercussions at centres such as Crewe and Swindon, where the railway workshops provide the principal employment.

On the L.N.E.R. system the organization has been divided into three areas—Southern, North-Eastern, and Scottish—each under a divisional manager, with the express purpose of enabling a large number of questions to be settled locally.

Those who have a detailed knowledge of local conditions will be aware of numerous complaints on the part of both the public and of local railway officials that headquarters cannot fully appreciate

Facing page 33.





NEW TYPES OF LOCOMOTIVE ON THE L.M.S.R.

(*a*) Stream-lined 4-6-2 locomotive, "Coronation," No. 6220. At speeds over 60 m.p.h. stream-lining considerably reduces fuel costs and enables higher speeds to be obtained economically.

(*b*) Garratt locomotive, No. 4972, as used to haul heavy goods and mineral trains without the assistance of a second locomotive.

local conditions and that considerations and facilities suitable enough, say, for the London area are not so suitable for Scotland, Yorkshire, the South-West, or Lancashire. Nor can it be said that the experience of recently formed large-scale transport amalgamations, such as the London Passenger Transport Board or the Northern Ireland Transport Board, has been any too happy. The former was not able in 1938 to meet its obligations to its junior stockholders, and the latter is in need of drastic reconstruction. The London Passenger Transport Board has been faced with the difficult task of bringing its services up to a modern level, and has been spending £45,000,000 on improvements. It has no surplus or reserve fund, and it is possible that its financial position is to be explained by progress being in advance of revenue receipts. Under the provisions of its Act, the Board has no discretion in the disposal of its earnings, and so cannot build up a reserve which might be applied to constitute a buffer between good and lean years.

Charging Powers.—The Railways Act, 1921, introduced fundamental and far-reaching changes in the charging powers of the railways. A Railway Rates Tribunal was established with very extensive powers of regulating rates, fares, and other charges. Railway charges are fixed by this Tribunal so that together with other sources of revenue they will, "so far as practicable, yield with efficient and economical working and management," an annual net revenue of approxi-

mately £50,000,000 (called the standard revenue), equivalent to the aggregate net revenues of the constituent and subsidiary companies in 1913, together with certain allowances such as a reasonable amount on additional capital expenditure since 1913, together with an allowance up to 33⅓ per cent. of any economies that might be effected through amalgamation. The standard revenue, if it were obtained, would yield about 4.7 per cent. on the capital receipts of the four companies, including an allowance of £400,000 in respect of early economies rendered possible by, or in anticipation of, amalgamation. The Tribunal is required each year to review the position, and, subject to the railways being efficiently managed, it was contemplated that any failure to earn the standard revenue would be met by an increase in charges, just as any excess would be handed back to railway users by means of decreased charges. So far the standard revenues have never been earned, but few alterations have been made in the charges, as it was felt that any changes would not have led to increased revenues.

If in any year there is a surplus over the standard revenue, 80 per cent. of this is to go to the reduction of charges and 20 per cent. to be retained by the company.

The Act substituted in place of the former rigid system of maximum rates a system of standard charges for each class of a complicated classification incorporating no less than sixty-six classes. Though the standard charges are variable by

the Rates Tribunal, the machinery for rate revision has proved over-elaborate, and the railway companies complain that it has introduced new rigidities in rate fixing.

There was, of course, nothing new in the classification system itself, except for its complexity, as the tariff method of charging goes back to the earliest days of the railways, being inherited by them from the canals and turnpike road trusts.

The Railway Classification.—The present British railway classification, which came into operation on the "Appointed Day," namely, January 1, 1928, is very elaborate, and it is no wonder that it took practically seven years from the passing of the Railways Act, 1921, to hammer out the details of the various charges, which had to be so fixed as to produce, if possible, the standard revenue.

It is divided into five main sections with numerous subdivisions. Section I. relates to the classification of goods by merchandise train and is subdivided into five parts, namely, A, General, B, Timber, C, Returned Empties, D, Rolling Stock running on its own wheels, and E, Dangerous Goods.

Section II. gives a classification for livestock carried by merchandise train.

Section III. is a classification of perishable merchandise by passenger train or other similar service. There are two divisions, one relating to milk traffic and the other (with four subdivisions) referring to various kinds of fish, flowers, vegetables, and other foodstuffs.

Section IV. classifies merchandise (other than perishables) and livestock by passenger train or other similar service. There are thirteen groups in this section, to each of which specific scales of charges apply. These groups include general parcels, newspapers, returned empties, livestock, bicycles, motor cars, caravans, and corpses.

Section V. is a classification of goods for insurance under the provisions of the Carriers' Act, 1830, as amended by subsequent Acts.

Section IA.—the general classification of merchandize—is the most extensive, as in it there are twenty-one classes in place of the eight classes of the former statutory classification which was in use from about 1890 to 1928. It is published in a book of about 400 pages, and enumerates some 6,000 different commodities, each with its appropriate classification. The lowest rates are those for Class 1, and the highest for Class 21. In general, the market value of a commodity determines the class into which it falls, since the principle followed is that known as "charging what the traffic will bear." Expensive commodities, such as cigars, precious metals, or glasshouse fruit, are charged higher rates than articles of low value per unit of weight, such as grain, iron ore, ashes, or fire-clay.

The classification of certain commodities is minutely discriminated. "Twigs, osiers, and willows," for example, are classed according to their colour. Two tons of green twigs are in Class 10; the same quantity of brown twigs are

	Class.
Galvanising Pots, *iron or steel*	10
Galvanising Troughs, *iron or steel*	10
Gambier [*Exceptional rates for List U apply.*]	9
Gambier Extract—(*see* Extracts).	
Game, *e.o.h.p.*	20
Games Apparatus *such as* Archery, Badminton, Bowls, Cricket, Croquet, Golf, Hockey, Lacrosse, Polo	19
Games Apparatus (*Indoor*), *such as* Chess, Dominoes and Draughts	18
Gangways, *Ships'*, *wood, or wood and iron or steel*	16
Gannister	2
Garancine—(*as* Dyes).	
Garden Arches—	
Metal or wooden, in sections, or in bundles—	
Minimum 2 tons per truck	16
Less than 2 tons per truck	17
E.o.h.p.	19
Garden Chairs, Seats and Tables, *rustic wood*	17
Garden Chairs, Seats and Tables, *e.o.h.p.*—	
Common, folding, not stuffed, in cases or bundles	17*b*
In parts, in cases or bundles	13
E.o.h.p.	18*c*
Garden Edging Tiles—	
Common clay, glazed	6
NOTE.—*If not in casks or cases, as damageable goods not properly protected by packing.*	
Common clay or concrete, not glazed	5
4 tons	6
[*Exceptional rates for Bricks, clay, common, apply, if lower.*]	
Metallic	13
Garden Engines—(*as* Machines and Machinery, Spraying, pp. 212 and 219).	
Garden Fencing, *rustic wood*—(*as* Garden Arches).	
Garden Frames—	
Common wood, glazed, in cases or crates—	
Minimum 2 tons per truck	15*b*
Less than 2 tons per truck	17*b*
Common wood, unglazed, packed or in bundles—	
Minimum 2 tons per truck	15
Less than 2 tons per truck	17
Garden Hammocks, *Couch*	18*c*
Garden Lights—(*as* Frames, *Garden*).	
Garden Netting, *not oil-dressed*—(*as* Netting, *not oil-dressed*).	
Garden Netting, *oil-dressed*—(*see* Dangerous Goods Classification).	
Garden Rake Heads, *common* [*Exceptional rates for Hardware apply, if lower.*]	16
Garden Rakes, *common*	16
Garden Rollers, *hand*	11
Garden Rollers, *Steam or Motor*—(*see* Machines and Machinery, Rollers, p. 217).	
Garden Shears—(*as* Hardware, *i.e.*, Metalware).	
Garden Soil	5
Garden Syringes—(*as* Hardware, *i.e.*, Metalware).	
Garden Tools and Accessories, *mixed packages of*	18
Garlic—(*as* Vegetables, *not hothouse*, *e.o.h.p.*).	

charged as Class 12, but if they are white they go in Class 14.

The principles followed in the classification cannot be better explained than by illustrations of the actual items, and for this purpose a page from the General Classification is reproduced on page 37 by permission of the Railway Clearing House. Goods are carried at Company's risk unless an owner's risk rate applies, as indicated by a letter added to the class rate (*e.g.* hammocks, 18*c*). The following list, giving an example from each of the twenty-one classes, will illustrate further the nature of the classification.

Class 1.	Iron Ore.	Class 12.	Dog biscuits.
„ 2.	Gravel (*e.o.h.p.*).	„ 13.	Iron ladders.
„ 3.	Lime in bulk.	„ 14.	String (*2-ton lots*).
„ 4.	Rock salt.	„ 15.	Chicory.
„ 5.	Marl.	„ 16.	Dried dandelion roots.
„ 6.	China clay.	„ 17.	Christmas cards.
„ 7.	Copper ore.	„ 18.	Mistletoe.
„ 8.	Lamp posts.	„ 19.	Fox skins.
„ 9.	Crude asbestos.	„ 20.	Leather hat-boxes.
„ 10.	Wood palings in bundles.	„ 21.	Platinum.
„ 11.	Lead oxide.		

NOTES :

E.o.h.p. signifies " except otherwise herein provided." For Classes 1 to 6 inclusive there is a minimum load of six tons, for Classes 7 to 9 inclusive four tons minimum. For Classes 12 to 21 inclusive, unless otherwise stated, there is no minimum, but for consignments not exceeding three cwts. a small additional charge (known as the " smalls scale ") is made.

Modifications to the general principle of

" charging what the traffic will bear " occur where commodities involve special difficulties in handling, where they load badly or where they are sent in small lots. For example, the lowest rates only apply if commodities are sent in bulk ; methods of packing are also taken into account, *e.g.* cider sent in casks is rated in Class 11, if sent in crates in Class 16, and if in stoneware jars in Class 18.

There has been much controversy regarding the application of the principle of " charging what the traffic will bear." It has been denounced as exploitation, or it has been described as unfair that certain goods should be carried at cheap rates. But actually the principle worked well when the railways had a practical monopoly of inland transport, since traders were protected from exploitation by State regulation. The principle has been universally adopted by railway undertakings, both State and company owned, in every part of the world. Now, however, the system is in process of being broken down by road transport competition.

" Charging what the traffic will bear " has been adopted largely because the alternative of charging according to the particular cost of the service is inapplicable to the conditions of rail transport. A railway is a complete system of transport which involves an immense capitalization, and the fixed charges involved in providing the permanent way, signalling, rolling stock, stations, yards, buildings, and plant are a very high proportion of the total costs. The cost of

providing and maintaining a given section of line may be very much the same whether it carries fifty or a hundred trains a day, though the receipts would be very different. It is not possible to allocate costs against particular forms of traffic, because so much of the cost is general to all kinds of traffic. It has been estimated that probably half the total expense of operating a railway is fixed and independent of the traffic. A small diminution in traffic will immediately send up the average cost per ton whilst an increase will send it down. Hence a railway is justified from the commercial standpoint in quoting low rates for traffic which would not otherwise be carried, provided it covers any special expenses involved, such as the wages of train men or the cost of fuel, and contributes something towards the general expenses. This is not unfair to the more highly-rated types of traffic, because if the lower grade traffic were not carried they would have to bear all the cost. Actually, also, certain kinds of lowly-rated traffic such as coal and other minerals are cheap to handle by rail, since this traffic passes in large consignments, and involves little handling or expensive terminal equipment. In general, also, it may be said that the essential principle of the classification is regarded as both desirable and equitable by traders as it gives low rates to the essential raw materials of industry. When the principle was under discussion in 1921 it was supported by the traders' representatives, and again in 1929 the principle was endorsed by the traders' associations in

evidence before the Royal Commission on Transport.

The complex series of classifications are of statutory force, and the present arrangement was prescribed by the Railways Act, 1921. As may well be imagined, the change over from the former classification, which had been prescribed by the 1888 Act, involved a prodigious amount of labour and took some seven years to prepare. Almost immediately, it had then to be modified by the introduction of numerous exceptional and special rates to meet keen road competition.

Exceptional Rates.—Standard charges are fixed by the Railway Rates Tribunal for each of the classes; and these charges cannot be varied by the railway companies at their discretion, either upwards or downwards, without the express permission of the Railway Rates Tribunal, except by way of an exceptional rate, and then only within certain limits, as the Act provided that any exceptional rate more than 40 per cent. below or less than 5 per cent. below the standard rate must be referred to the Tribunal. In 1933, by the Road and Rail Traffic Act, this provision was amended, so as to allow the companies to quote exceptional rates less than 5 per cent. below the standard rate applicable to the commodity.

Exceptional rates are defined as rates lower than the ordinary class rate for particular commodities, which are granted in special circumstances. They may be quoted, for example, to

meet road competition, or because traffic passes in full train or wagon loads. The railway companies have not a free hand in quoting exceptional rates, even within the statutory limitations, as they are bound by the law of undue preference not to give a favour to any trader which is not applicable to every other trader in like circumstances. This is a serious limitation on the grant of special terms, since though such a rate might secure certain traffic in particular circumstances, it might involve the companies in serious financial loss if made general. Moreover, it means that every application for an exceptional rate has to be carefully scrutinized, and this takes time. In the meanwhile, the traffic may be captured by road competitors.

Every exceptional rate has to be entered in the rate book at the station from which it applies, and the rate book must be available for public inspection. This became a sore point with the railway companies when competitive road transport broke down the former monopoly of the railways. The companies complain that their road competitors can find out all about their transactions, while they know nothing about those of their road rivals. Since every rate has to be published, the station rate books among them contain several tens of millions of entries.

It was the intention of the Railways Act, 1921, that the number of exceptional rates should be greatly reduced, through the absorption of former exceptional rates into one or other

A STATION RATE BOOK

Between *Nottingham* and	Mileage for Standard Rate.		Bottles, Class 12. C. & D.	Exceptional Rates (per ton).			
				Iron and Steel, List "K."	Timber, List "V."	Timber, List "W."	Yarn, Woollen and Worsted. C. & D.
	m.	ch.		2 tons.	2 tons.	2 tons.	
Southwell . .	16	21	..	..	..	..	..
Blidworth & Rainworth .	20	75	..	8/7	6/2	6/9	..
Long Eaton .	6	65	..	4/6	4/7	5/-	..
Stapleford & Sandiacre . .	8	32	..	4/6	4/7	5/-	15/2
Stanton Gate .	8	26	..	4/6	4/7	5/-	..
Heanor . .	11	39	12/1	4/10	5/5	5/11	17/4
Pye Bridge .	14	32	..	4/6	6/2	6/9	..
Doe Hill . .	20	51	..	..	6/10	..	..

NOTE.—The above has been abstracted from a page of a station rate book. On the actual page there are 23 commodities and 41 stations.

of the twenty-one classes which replaced the former eight classes. On account of the increasing severity of road competition the anticipated reduction was not obtained, and since 1928, when the new classification came into operation, the proportion has steadily increased, till now well over two-thirds of the traffic is carried at exceptional rates.

Agreed Charges.—An important development took place under the Road and Rail Traffic Act, 1933, which allowed the railways to make "agreed charges" with individual traders. According to this Act, "a railway company may, if it thinks fit, make such charge or charges for the carriage of merchandise of any trader, or for the carriage of any part of his merchandise as may be agreed between the company and the trader." This was the first important break with the traditional practice of the railways of charging according to a tariff, and was a move in the direction of individual contract prices negotiated with individual traders, which is the general rule in road haulage and in most other businesses.

Complete freedom was not granted to the railway companies, as the consent of the Railway Rates Tribunal must be obtained in all cases, and the object of the agreement must not be one which could adequately be secured by means of the grant of appropriate exceptional rates. In respect of agreed charges approved by the Rates Tribunal, a railway company is exempt from the obligation to make equal charges to all persons under like circumstances and from the obligation to accord no undue preference to any person.

In practice, agreed charges have taken the form of a unit charge, *e.g.* 3s. per ton, or 2s. per pig, for the carriage of goods or livestock from one or more specified forwarding points, either to specific stations or to all stations in Great Britain (including, in some of the contracts, the Channel Islands or the Isle of Man). The

rates are irrespective of the mileage traversed by any particular consignment, being a flat charge for each ton, package, or animal. The agreements include a provision that the trader should hand to the railway company the whole of his traffic (excluding in some cases local traffic) to which the agreed charges are applicable.

In one case, that of F. W. Woolworth and Co., Ltd., the charge is an agreed percentage (now 3.95 per cent.) of the total value of the goods purchased by the firm. The introduction of this particular agreement was a distinct innovation in railway charging, though such charges are not unknown among road hauliers. The tonnage conveyed under this agreement is easily the largest under any agreed charge.

The principle which has been followed in computing the various agreed charges has been that of attempting to obtain as nearly as possible the true average charge, or cost per unit, of the trader's traffic, over a representative period in the past; sometimes this is an average of both rail and road costs, where the trader was previously employing both road and rail.

In so far as the charges are based on average rail costs over a former period, they bear some relation, though it is rather indefinite, to the standard charges, or exceptional rates applicable. Agreed charges are subject to periodical revision, and should there be any substantial change in the nature of the trader's traffic, he is required to notify the railway companies. Experience has shown that there is seldom any material

alteration in the distribution of a trader's traffic as the result of the introduction of an agreed charge, but where it does occur there is little difficulty in securing a satisfactory adjustment in the quantum of the charge.

The system of agreed charges has proved attractive to many traders, especially those engaged in nation-wide distribution, or as mail-order houses. It facilitates their business and enables them to effect accounting and clerical economies. On their side, the railway companies secure the advantage of obtaining all the traffic of the trader in the commodities covered by the agreement. The system has been of considerable assistance to the companies in enabling them to secure traffic previously conveyed by traders in their own vehicles operating under "C" licences. The risk of diversion to road haulage is eliminated, and the principle has also been useful in assisting the companies to secure traffic passing to a number of destinations in small consignments for which it would be undesirable to quote exceptional rates. Clerical economies may also be effected, though these cannot be given an exact monetary value.

In all, there are now over 850 agreed charges in operation, representing a gross railway turnover of just over £4,000,000. The arrangement is confined almost entirely to the higher classes of merchandise, and so far no attempts have been made to apply it to traffic in the lowest grades of the classification.

In some quarters the system of agreed charges

is viewed with a certain amount of misgiving, as it is felt that no longer can traders rely on non-preferential treatment. Its opponents feel that those traders who have been successful in negotiating an agreed charge may secure advantages not obtained by others, and in particular it is asserted that small firms might thereby be placed at a disadvantage as compared with their large-scale competitors. The railways would no doubt reply that the system has been forced upon them, owing to the fact that traders have adopted a contract system for their road haulage. Traders, the railways say, cannot have things both ways; and, in any case, if a trader considers that the grant of an agreed charge to a competitor detrimentally affects his business, he has a legal right to apply for a similar charge to be fixed for his merchandise.

"*The Square Deal.*"—In November 1938 the railway companies launched a campaign under the slogan, "The Railways ask for a square deal," which has been pursued with great determination and with all the powerful resources at the control of the companies. In essentials, the claim put forward has been for greater freedom in quoting charges for the conveyance of merchandise traffic by rail. The proposals did not extend to passenger fares, which would continue to be regulated by the Rates Tribunal, if the companies' suggestions as to merchandise rates were accepted. The campaign was inaugurated because the railways felt themselves to be unfairly handicapped by the dead hand of the State in meeting

the competition of road transport. Road hauliers, they pointed out, could quote what charges they liked, without incurring any obligation to grant similar rates to other traders, or even to repeat the bargain. In contrast, the railways are bound by the law of "undue preference" and must publish all their rates for public inspection, while if the reduction in any particular case should be substantial, the railways have to obtain the express permission of the Railway Rates Tribunal. This body, the railway companies explained, is a court of law whose proceedings are public and often protracted, and the costs are paid by the railways themselves. Road transport contractors, on the other hand, being under no statutory obligation, can pick and choose their traffics, their rates need not be published, and they are not bound by a statutory classification. "Road carriers, canal carriers, coastwise carriers," it was said, "are free to quote without restriction whatever charges are appropriate in each case. Railways alone are restricted." It was pointed out that "in fixing rates and conditions for carrying merchandise the railways are bound by statutory controls and regulations which have lasted a hundred years, and grown more rigid with age." This, perhaps, was putting the case rather strongly, because though they have had for many years a complicated and rigid classification imposed upon them, the Railways Act, 1921, gave them a much greater flexibility in regard to charging powers than they had possessed since 1888. Yet it is true that the technique of altera-

tions in rates of any substantial amount is very cumbrous and uncertain. They demanded that the shackles of a century which "fetter the railways alone and well nigh strangle their goods traffic" should go, as should also out-of-date rules applicable to long-vanished conditions. A short Act of Parliament was demanded which would give to the railways the freedom enjoyed by other forms of transport. They proposed that restrictions inherited from the past, such as the cumbersome classification of goods, the publication of all their rates, and the provisions about undue preference should be repealed, so that they might operate on equal terms with other forms of transport.

The railways did not ask that any further restrictions should be placed on other forms of transport, nor did they suggest that their liabilities under the Carriers' Act should be altered in any way, nor that the law relating to their obligations to provide reasonable facilities, through rates or standard conditions of carriage should be altered. They stated they had no intention of refusing to carry any traffic which was offered to them in suitable conditions, and that where they were common carriers they would remain common carriers.

Speaking to the Manchester Chamber of Commerce, Lord Stamp, President of the L.M.S.R., stated, "What we are urging now involves no new principle on our part—it is an old principle of equality that we have been urging for some years. We have pleaded all along that we ask

only for conditions of equality with our competitors, and then we are prepared to allow a new equilibrium of economic forces to establish itself, and the division of the total traffic will find its level according to public convenience and the economic character of the goods and services."

The railway companies, it would appear, felt impelled to demand greater freedom in regard to their charging powers because, as it seemed to them, there was no likelihood that a report of the Transport Advisory Council to the Minister of Transport recommending the control of road transport charges would be implemented in the near future. This report was issued in July 1937 and expressed the view that all forms of transport should, where practicable, be rate-controlled, and that a rate structure for road transport should be devised and enforced; but though the Government accepted the principles of the report, no legislation was introduced to carry them out.

As might be expected the proposals of the railways evoked much discussion and not a little controversy. To most members of the public the campaign came as a sudden shock and was thereby the more effective; though the new claim of the railways is largely to be explained from the fact that they had lost patience at the slow progress achieved in implementing the report of the Transport Advisory Council, and from the fact that there had been a serious decline in their receipts during the latter part of 1938 and a renewal of the diversion of traffic to the roads. Discussion on national security in time of war had

focused attention on the importance of the railways as an element in national defence, and this added greater weight to their claims.

Opposition to the railway demand for a "square deal" has come from various quarters. Road carriers naturally did not view it with equanimity, and retorted by demanding a "fair deal" for themselves. They did not so much oppose the claim of the railways directly, but urged that they, also, should be freed from a too rigid control, and in particular from certain regulations relating to the licensing of vehicles imposed under the Road and Rail Traffic Act, 1933. They claimed that licences should be automatically renewed, provided the conditions have been observed, and that road carriers should be given more ample opportunities to obtain additional licences for new vehicles. They also pointed out that the railway companies had strenuously opposed applications for licences in the traffic courts, and they urge that the right of the railways to object to the granting of carriers' licences should be confined to objections relating to breaches of the law.

Lack of reasonable security is at present one of the greatest difficulties with which road hauliers have to contend, since their licences to operate are valid only for five years at the most, and that period has only recently been extended from three years. It does not matter how careful a haulier may be to see that all the regulations are observed, how well his business is conducted, or how great is the demand for his services—

> "He can be completely put out of business at the discretion of the Licensing Authority, merely on the evidence proved by his railway competitors that they can provide alternative accommodation for the traffic. The scales are heavily weighted in favour of the railways in this regard, and they make the utmost use of their privileged position, the expressed preference of the trader being in many cases ignored and his free choice of method of transport denied to him." [1]

The road interests also contest the argument put forward in some quarters that road transport does not contribute the full cost of its roadways. They point out that though all the money received from road transport taxation does not go to the roads, yet in 1938 they contributed no less than £88,000,000 (of which £33,500,000 was paid in taxation by goods vehicles), while the cost of maintaining the roads was £60,000,000. The railways have also claimed that whereas they have had to defray the capital cost of their systems in full, road transport has had its roads provided by the community. To this argument, the road interests have made various replies. It is said that the railways also largely depend on roads for the collection and delivery of their traffic, or that in the past they had monopolistic privileges which enabled them to earn steady dividends on the capital they had expended. As a way out of the difficulty of effecting a fair allocation of capital charges between different forms of transport, it has been suggested that the State should take over responsibility for the

[1] Captain W. F. Strickland, M.P., in an address to the Manchester Chamber of Commerce.

capital costs of the specialized track (road, permanent way, or canal), leaving the undertakings themselves to meet costs of operation. Such a scheme, however, would involve many difficulties in its detailed application.

Opposition to the railway companies' claims for a " square deal " has also come from those who fear that the removal of restrictions on railway charging powers would lead to local rate wars between road and rail resulting *either* in further loss of revenue to the railways *or* in driving road hauliers out of business leaving a monopoly to the railways, who would then raise rates.

Yet another line of opposition is from those who fear that the railways would use their large financial resources, even at a temporary loss, to undercut their rivals in competitive traffic, probably thereby granting favours to large users which are not available to small traders. It is also asserted that they might raise rates against those kinds of traffic which are not competitive with the roads. Rates quoted for given types of traffic between two given points would depend in this event less on the distance or the value of the commodity than upon the nature of the competition. Rates might vary from place to place, from time to time, or from one customer to another. Finally, there are some who fear that the removal of railway charging restrictions might lead to the ultimate formation of a big road-rail combine which would exploit the public.

Against these contentions it may be said that the railways would be ill-advised to engage in a

rate-cutting war, and it is not likely that they would do so. It would not be practicable, according to railwaymen themselves, to attempt to drive road hauliers off the roads, as the companies would probably bankrupt themselves before it was accomplished. Further, the great safeguard possessed by traders against monopolistic powers is that they can now, if necessary, provide their own transport by means of motor vans and lorries. There are no restrictions on the number of "C" licences, and any trader can obtain the necessary permission to operate vehicles for his own purpose.

As regards publication of rates, Lord Stamp stated in the address to the Manchester Chamber of Commerce that "the railways think that in following commercial practice and giving full publicity to their price lists at the points where they are wanted, and also in providing the fullest information for any difficulties that are raised, they are meeting all reasonable requirements of publication in contrast with competitors who are under no obligations at all."

Arising out of discussions between the railways and traders, various safeguards were accepted by the companies. They proposed that there should be periodical meetings at regular intervals between the various trade associations and the railway companies for the discussion of rates and charges or other matters of common interest. Such regular contacts between the parties, it was urged, would ensure friendly discussion and understanding. The companies have also agreed

that all rates must be reasonable rates, and that if a trader or agriculturalist considers any rate to be unreasonable he can appeal to some such body as the Railway Rates Tribunal, which would have power to decide on the reasonableness of the charges under discussion. To prevent unnecessarily formal proceedings, a trader belonging to any recognized trading association, it was suggested, could bring his complaint before a meeting of his association and the railways before he appealed to the Tribunal.

A basis of agreement was also reached with road transport representatives, and this included a decision to establish a central consultative committee to arrange measures of co-ordination and agreements as to rates for particular commodities or areas. As a safeguard for traders there would be a right of objection before a judicial tribunal.

The Transport Advisory Council in a report published in May 1939 recommended, subject to adequate safeguards for other industries, a material relaxation of the present statutory control of railway goods charges. The Council stated that its recommendations should be regarded as a temporary measure to meet an emergency, and therefore should be limited in duration to a period of not more than five years, or such shorter period as might be necessary to establish adequate co-ordination. The Council approved the proposals for regular periodical conferences between the railways and traders for the purpose of discussing matters of common interest, including complaints as to freight charges, and proposals

for increases in charges. If agreement cannot be reached in any particular case, the Report recommended that the matter should be referred to the Railway Rates Tribunal, which would then fix such charges as it considered reasonable after taking evidence from both sides. It was also recommended that effect should be given to the proposals in the agreement between the railways and the road haulage industry that "agreed charges" (which would not necessarily be the same for the two industries) should be referred to a Tribunal for approval, and should then be made binding on the railways and all road hauliers.

The Minister of Transport announced in the House of Commons on May 24, 1939, that the Government had decided to accept in principle the recommendations of the Transport Advisory Council, and that appropriate legislation would be introduced as soon as possible in the next session of Parliament.

While the evolution of a correlated road-rail rates structure will probably take some considerable time to achieve, the removal of many of the restrictions which have hampered the railways should prove of considerable value to them. Their original claims have been greatly diluted, and the agreements with industry would appear to make significant increases in rates practically impossible. The Railway Rates Tribunal under present legislation has to take into account the attainment of a standard revenue; but under the new proposals, the determinant would be the reasonableness of the charge.

Chapter III

RAILWAYS AND THE PASSENGER

The conditions of modern life have led passengers to make very exacting demands on transport. What sufficed in more leisurely days is now deemed quite insufficient by the travelling public, which insists more and more on higher speed, greater frequency of service, and greater comfort. The pace is now set by standards based on the possession of private motor cars, and public transport undertakings are expected to provide almost equivalent services, or where long-distance journeys are involved even better facilities.

Speed and comfort are the two outstanding advantages which the railways can offer as compared with their road transport competitors. On main-line coaching stock, standards of comfort have now reached a very high level. The wide low windows, good upholstery, well-sprung seats, arm-rests, and shoulder lights are a vast improvement on the equipment of older stock. Insulation against noise is now provided in the most modern type of coaches, such as those running on the " Hook Continental " train between London and Harwich. These vehicles have sponge rubber mats on the floors, asbestos

acoustic blankets in the sides, floors, and roofs, and double-glass windows. In addition they are air-conditioned and heated ; the interior atmosphere being changed every four minutes, there is no need for windows to be opened.

The riding of carriages has also been improved and so has the permanent way, thus making for still greater comfort. Considerable attention and much research has been devoted to these factors as was explained in a broadcast address by Sir Harold Hartley (Vice-President and Research Director of the L.M.S.R.). He remarked :

" Comfort depends on cutting down vibration, jolting and noise, even at the highest speeds, and on providing good heating, ventilation and lighting. Modern invention can help in all these ways. Smooth running depends on the design and maintenance both of the rolling stock and of the permanent way. As Lord Kelvin said, you must measure a thing in order to know about it, and to-day we can measure and record any irregular movement of the carriages. A recording instrument can be carried in a train over the section of line to be tested, and it shows at once where the track needs improvement, and whether the alignment and the cant of the curves are correct. And the gangers who maintain the tracks now have instruments that tell them exactly how many shovelfuls of ballast to put under a sleeper in order to make the rails exactly level under load. The result is not only a better track, but a better track at less cost, because when the level is adjusted by exact measurement it ' stays put ' fifty to eighty per cent. longer than it did when the packing depended on the skill of the ganger working by eye.

" Other records of the vibration of a vehicle show what is wrong with its springing or suspension, or with the contour of the tyres. The smoothness of the running of a coach depends very largely on the shape of the treads

of its tyres; if they are so worn that they roughly fit the shape of the rail, you are apt to get those unpleasant oscillations that are known as 'cinder-sifting' or 'bogie-hunting.' Nowadays we use a ciné camera to get exact records of the effect of differently-shaped tyre treads when running at speed, in order to show which is best." [1]

The more substantial construction and the greater length of railway coaches enable a far higher standard of comfort to be provided on a train than is possible on a motor bus. In a railway carriage it is possible to read with comfort, lighting is good, meals can be served, sleeping accommodation can be provided, lavatory accommodation is available, carriages are steam-heated (at the control of the passengers), and a certain freedom of movement is possible. Improved ventilation has eliminated draughts, and on some modern trains air-conditioning is provided. Not all rolling stock, however, reaches the high standards attained by the best trains. There is still much antiquated rolling stock in use, especially on local and cross-country services, and this is the more criticized since the standard set by new stock is so high. Brightly coloured, attractive, and clean exteriors to carriages and locomotives have considerable publicity and psychological value, as witness the popularity of the G.W.R. and the former Caledonian Railway.

A notable improvement of recent years has been the introduction of buffet cars. Though experimental vehicles of this type were introduced

[1] Printed in *The Listener*, March 16, 1939, page 566.

between London and the Midlands in 1899, it was not until 1932 that the first modern buffet car commenced running between London and Cambridge. There are now 93 buffet cars in operation which serve *à la carte* refreshments, apart from 670 restaurant cars which are utilized on the main long-distance routes.

Railway passenger services may roughly be divided into three categories. First, there are the main line express services running over long distances, and for the most part radiating from London. Second, there are the short-distance, intensive suburban services carrying passengers in large numbers between their suburban homes and the centres of large cities. Third, there are the numerous local and cross-country services which link up the provincial towns and cities.

Local Services.—It is in connection with their cross-country and local services that the railways fall most behind their road competitors. Such rail services are only too often slow, inconvenient, and tedious. In particular, the last trains at night are among the slowest and most inconvenient, and they often leave at an hour too early to enable social and other evening engagements to be fulfilled. No doubt the difficulties involved in improving such services are very considerable. At junctions there may be conflicting time-tabling with main line trains : traffic is not sufficient to justify a frequent service, and road competition is severe. Various attempts have been made to evolve an inexpensive small unit for local services in the form of rail-cars driven by steam or Diesel

engines, but as yet, at any rate, no completely satisfactory rail-car has been evolved. The rail-car is an inelastic unit and cannot be strengthened by attaching extra coaches, as is often necessary on market days, Saturdays, or other special occasions. Rail-cars have little reserve of power, and are therefore slow on adverse gradients. The most hopeful solution would appear to be the adoption of the push-and-pull type of train, which can be driven from either end, and which can take extra vehicles if required. So far, however, there have been few attempts to develop this type of train, though further experiments are now being made by the L.N.E.R.

Through Services.—Passengers generally expect the railways to provide direct services between practically all centres, and they are impatient of journeys which necessitate changes at junctions. Provided there is sufficient traffic, it is advantageous to the railway company to operate direct trains, as this increases the average useful train mileage, and avoids the expense of transferring luggage or parcels from one train to another. Where traffic is insufficient for a through train, many of the advantages can be retained by providing through carriages, though this involves expense in shunting, and may be a cause of delay. If the train is late, serious difficulties may ensue, and other trains be delayed while the carriages are being shunted, or while they are standing at the platform. "Slip coaches," which can be detached from a train moving even at a speed of 60 m.p.h., were at one time more

popular with the companies than they are now. They can be used to provide services to intermediate stations without delaying the express train, but they are expensive to operate, and the return journey has to be made by a stopping train. In 1914, there were some 190 slip services, but to-day there are only 23 ; one being operated by the L.N.E.R. and 22 by the G.W.R.

The vehicle is detached by a " slip guard," who moves a lever which uncouples the vehicle and detaches the vacuum brake and train heating pipes, automatically sealing the vacuum brake pipe on the main portion. On the slip portion, the brake is automatically applied to enable the train to draw clear. The slip guard releases his brake when speed has fallen to about 15 m.p.h., and re-applies it when it is necessary to stop the coach at the station. Slip coaches are fitted with look-out windows, a bell or horn and an independent hand brake.

Railway Stations.—Railway stations, especially in the industrial areas, are often unattractive, neglected, and smoke-begrimed. This, however, need not be regarded as inevitable, even where conditions, as in the older industrial areas, are unfavourable. The London Passenger Transport Board has set a high standard, and many of the Board's stations are dignified and definitely attractive.

A distinguished architect, Professor A. E. Richardson, in a lecture on " Railway Stations," has given high praise to these stations, particularly those overground, which he said " leave

nothing to be desired," King's Cross is in his opinion the finest main line railway station in London. "The scale is satisfying, the material honest brick, the hotel is decently out of the way, and the lateral arcaded screen, well on the York Road side, is a model for all students of elementary building construction." But speaking of the average railway station he said, "Nothing has militated more to destroy the confidence of the public in travel by rail than the untidy railway station, unsheltered from icy blasts in winter, deprived of clean waiting rooms, denied all creature comforts, except stale refreshments." [1]

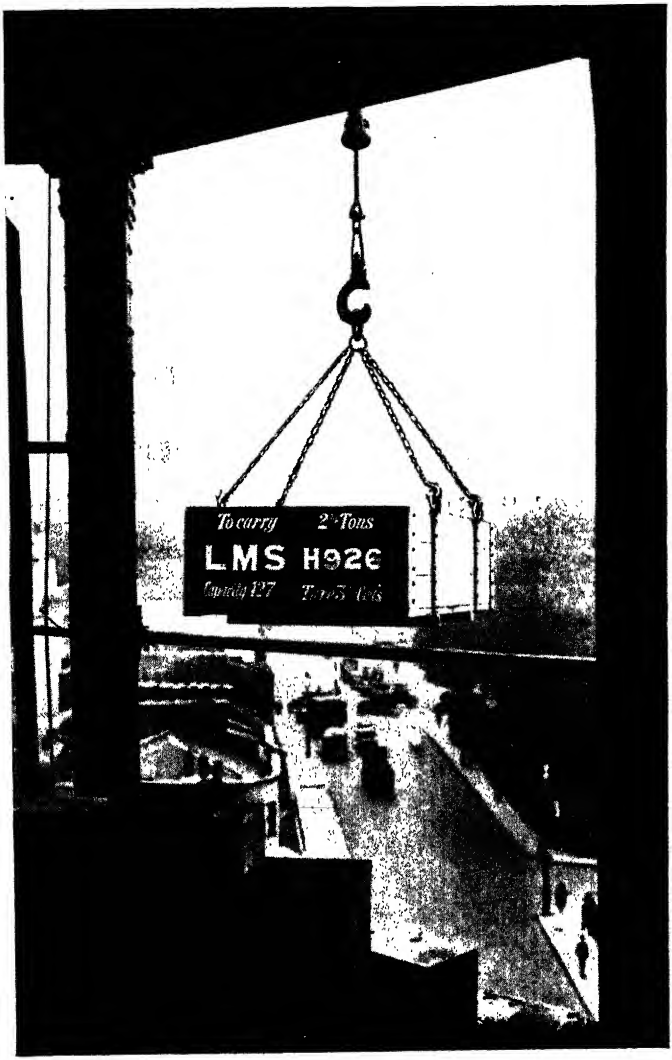
The railway companies are now making considerable improvements in numerous stations, A number, including Chesterfield, Exeter, Leeds, Sheffield (Victoria), and Twickenham, have either been remodelled entirely or extensively reconstructed. The L.N.E.R. has made a big effort to improve its stations by painting them in brighter colours, and attention is being paid not only to general appearance, but even to such details as the siting of automatic machines and the arrangement of advertisements. In marked contrast to certain stations which betray no attempt to make them attractive, there are others which are kept in excellent condition; some indeed with their carefully tended flower-beds and trim shrubs, or else with a wild profusion of flowers, are a joy to behold. To encourage such efforts the railway companies award prizes to the staffs of the best kept stations, taking into account

[1] Lecture to the Royal Institute of British Architects, April 24, 1939.

the particular circumstances and difficulties which have to be contended with.

High Speed Trains.—Probably the most spectacular achievements of British railways during recent years have been the inauguration of very fast passenger train schedules on selected routes. The first of the stream-lined, high-speed trains was " Silver Jubilee," inaugurated on September 30, 1935. This runs between Newcastle and London at an average speed of 67.1 m.p.h., and reduces the former 5 hour 10 minute schedule to 4 hours. This train has proved very successful, and a remarkable feature of the service has been its reliability and punctuality. The success of " Silver Jubilee " soon led to the inauguration of other special services of a similar nature, such as " The Coronation," running between Edinburgh and London, " Coronation Scot " between Glasgow and London, and the " West Riding Ltd." between Leeds and London.

These are all operated by specially designed, stream-lined trains which have been produced as the result of much detailed research into problems of air resistance. At low speeds stream-lining is of little practical importance, though it may serve to improve the appearance of a vehicle, but because air resistance is approximately proportional to the square of the speed, stream-lining becomes a considerable factor at speeds over 60 m.p.h. At 80 m.p.h., the stream-lined train is justified by a 10 per cent. saving in horse-power. Air resistance is increased by side winds, as they exert frontal pressure on



DIRECT SERVICE BY CONTAINER.

Open type container employed to convey building materials direct to the upper storeys of buildings in course of erection.

exposed parts such as the ends of the carriages, the under-frames or the bogies. Stream-lining, it has been found, enables the maximum attainable speed to be increased from 12 to 25 per cent according to the degree of stream-lining adopted. Engines are also stream-lined internally nowadays, and as Sir Harold Hartley has pointed out, " all the steam ports and passages have been re-designed, so that the energy of the steam is used in doing useful work in the cylinder and not wasted in forcing its way in and out." [1]

Experiments in the building of locomotives are still continuing, and a joint locomotive experimental station is being built at Rugby by the L.M.S.R. and the L.N.E.R. The problems of designing a locomotive are exceptionally complicated, as its weight is limited by the strength of bridges and its size by the loading gauge. There is still much scope for improvement, as a steam locomotive to-day is only about one-third as efficient thermally as a modern stationary engine.

The reductions in journey times that have been effected by these ultra-fast trains is remarkable. Thus, on an $8\frac{1}{4}$-hour schedule operating in 1930 between London and Edinburgh, a reduction of $2\frac{1}{4}$ hours has been effected. Between London and Glasgow, $1\frac{3}{4}$ hours have been saved despite the difficult nature of the West Coast route. Average speeds of 67.6 m.p.h. are now operated between London and Bristol, 65.5 m.p.h. be-

[1] In a broadcast address printed in *The Listener*, March 16, 1939, page 565.

tween London and Edinburgh and 61.7 m.p.h. between London and Glasgow.

Numerous other, though less spectacular, accelerations have been effected for ordinary express trains. Thus, on the L.M.S.R. in 1938 there were sixty-three services, totalling 6,317 miles, run by express passenger trains at average start-to-stop speeds of 60 m.p.h. or over, whereas in 1931 there were no trains of this type operating on that system.

Speed is a dominant factor in the present age, and the railways cannot afford to disregard it. Speed is definitely popular with the major part of the travelling public, and this fact is demonstrated by the good loading which is obtained for the fastest trains even where a supplement to the ordinary fare is charged.

But though cities such as Bristol, Leeds, Newcastle, Edinburgh, and Glasgow can be reached from London at 60 m.p.h. or over, there are as yet no such services to Birmingham, Liverpool, Manchester, Sheffield, and many other large cities. The 60 m.p.h. level ought now to be accepted, as it is in Germany and France, as the standard of speed on the main services from the Metropolis.

The demand for speed, however, raises a whole series of special difficulties such as track improvement, the strengthening of bridges, the elimination of severe curves, reactions on local passenger services and goods train schedules, the improvement of brakes, the better visibility of signals, the number and placing of signals, and the design of rolling stock.

Suburban Traffic.—In urban and industrialized areas, passenger transport has become a most important public utility service. It is nowadays a basic requirement for enabling people resident in the suburbs to work for their living or to find enjoyment for their leisure. During the past twenty years or so, the importance of adequate local transport has greatly increased owing to the transfer of population to the outskirts of the towns, and the growth of urban population at the expense of rural areas. There seems to be no end to the continual expansion of great cities. New housing estates have sprung up on the fringes of practically every city and town in the kingdom, frequently at considerable distances from the centre. Since the war, four million or more houses have been built, and the vast majority of these represent urban expansion. One consequence of this redistribution of population has been greatly to increase the amount of travel; and the average adult now makes 300 journeys by public vehicles per annum, which is roughly twice as many journeys as were made *per capita* in pre-war days. Motor buses, trolley buses, and trams naturally carry the greatest percentage of the short-distance traffic, as it is especially their field. The average distance travelled by passengers on corporation buses is only about $1\frac{3}{4}$ miles, and on company buses, $3\frac{1}{2}$ miles, whereas by rail the average is considerably higher. The railways are a very important factor in the handling of intensive suburban passenger traffic, especially in London where on an ordinary

week-day 1,294,000 passengers arrive in 4,217 trains at the fourteen principal termini of the main line companies, as compared with 1,129,000 passengers and 3,786 trains nine years ago. The railways are specially well fitted for carrying heavy traffic. A steam suburban train of 10 coaches offers seating accommodation equivalent to 800 third-class passengers, and the cost of handling traffic in large numbers is very low; hence cheap fares which work out at ½d. a mile, sometimes considerably less, are possible. The railways grant cheap rates for season tickets, whereas motor bus undertakings seldom find it economical to offer season ticket facilities; even when they grant cheap all-day tickets on their systems, there is generally a restriction that they cannot be used till after 10 a.m.

In some countries, including France, Denmark, and Sweden, double-deck coaches are used in order to increase the capacity of steam-operated suburban trains. In Paris, trains of this type consist of eight double-deck coaches, and such a train can accommodate 2,040 passengers, of whom 918 can be seated. Sliding doors, pneumatically controlled, are provided, which allow six persons to enter or leave at a time; and the whole coach can be loaded or unloaded comfortably within one minute. The system of double-deck coaches was introduced as far back as 1879 to avoid the expense of lengthening platforms. To reduce turn-round time at the terminals the trains are capable of being driven from either end.

The problems connected with operating intensive suburban passenger trains are numerous and complex. The traffic is definitely concentrated into peak periods, usually from about 7.30 to 9.0 a.m. inwards, and about 5.0 to 6.30 p.m. outwards, with perhaps a minor peak at mid-day and another in the evening. Even in London and the larger provincial cities, where there is much all-day traffic, the peak hours are very marked. At Waterloo Station 24,300 passengers arrive in an hour during the morning and in the evening 22,800 leave in a similar time. At Liverpool Street Station, 32,900 passengers arrive between 8.30 a.m. and 9.28 a.m., and between 6.0 p.m. and 6.59 p.m. 31,675 persons depart.

In purely industrial towns there may be very little traffic between the morning and late afternoon peaks. The flow is almost entirely unidirectional during peak hours with heavy traffic in one direction and almost negligible traffic in the other. The main problem, therefore, is to dispose of trains on arrival so that those following may be worked into the terminal. The problem of peak-hour loadings has become intensified considerably during the last twenty years or so, because the shortened working day has tended to concentrate traffic into a shorter period. Hence the attention which has recently been given to the possibility of " staggering " hours of starting at different factories, offices, works, and educational establishments. Locomotives and rolling stock may be required only for a few hours

in the day, and the staff may only be working for a small proportion of their guaranteed eight-hour day.

Suburban traffic conditions necessitate the provision of special trains, so as to obtain good acceleration on account of the frequent stops, and also a maximum number of seats per yard of platform. Platform lengths are often a limiting factor, since they cannot be extended indefinitely at city terminal stations as traffic grows. Close-coupled stock, of the articulated type where two carriages share one bogie, is, therefore, usually employed to obtain the maximum number of seats per yard of platform length.

Another limiting factor is the rate at which trains can be got out of the terminal station after unloading their passengers. Until they are got away they occupy the platform, while on leaving they may foul incoming traffic. Many ingenious efforts have been made to solve this problem. At the New York Central Station, an underground loop-line is provided to clear trains after they have unloaded, and a similar device is used at certain " Tube " terminals in London.

At Liverpool Street Station, London, which carries a very intensive suburban traffic, an ingenious system of " head shunts " as illustrated in Diagram I. opposite has greatly increased the capacity of the station. When a train draws in, another locomotive backs on to it from a small siding at the incoming end of the platform. The train engine is uncoupled, and when the train draws out the original engine follows it, but turns

into the siding to await the arrival of another train. The system is now about to be electrified,

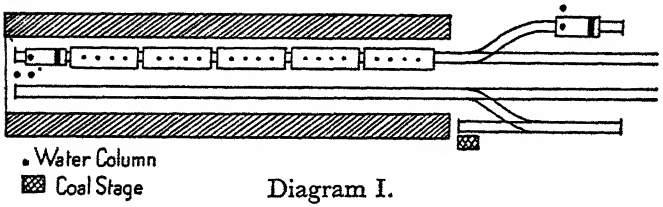


Diagram I.

as it is anticipated that this will speed up working on the lines leading to the station.

The usual method of enabling engines to run round their trains is illustrated in Diagram II. A third line is provided between the platforms; though this involves a waste of platform space, since the trains cannot be brought up beyond the cross-over without locking-in the engine. The third line also takes up valuable space in the station.

With electric trains or steam trains of the " push-and-pull " type the provision of a scissors

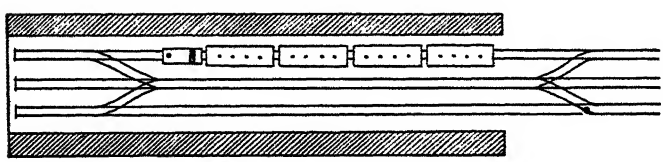


Diagram II.

cross-over, as shown in Diagram III., allows full freedom for trains to enter either platform and to leave by either line.

Apart from limitations imposed by the layout

and capacity of the terminal station, the possibility of providing intensive services depends on the capacity of the lines ; and in particular on the presence of any bottle-necks, such as at junctions, that may limit the working of trains. Various expedients can be adopted to increase the capacity of a saturated line, such as an overall increase of train speeds (though it would be useless to increase the speed of a few trains only). Maximum capacity is attained when all trains travel at the *same* speed ; and the higher the overall speed, the greater the capacity. Improved

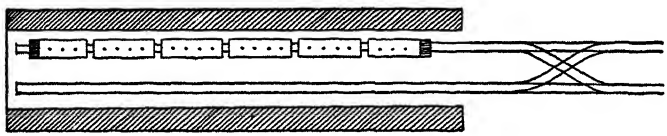


Diagram III.

signalling and shorter block sections is another method, since the fundamental principle of train working is that the line is divided into " block sections," and only one train may be in any given section at a time. Equalization of block sections in terms of running time is also necessary to obtain maximum capacity.

In the end, if traffic continues to increase, it is necessary to resort to either track duplication or electrification, both of which involve much additional capital expenditure.

It is frequently urged that British railways should electrify their systems, but the main problem involved is that of capital cost. Electrifi-

cation is an expensive matter, and means a great increase in the dead-weight capital cost per mile. On the other hand, actual running costs per mile for an electric train are less than those of a steam train. Hence there is a critical point in traffic densities up to which steam operation is cheaper, and beyond which electric operation has the advantage.

Holiday Traffic.—The railways have many advantages over road transport in catering for heavy holiday traffic, since a single train can provide accommodation for hundreds of travellers, and rail costs are low when intensive traffic is available. An outstanding example of what can be achieved by rail is that of the very heavy traffic to and from Blackpool during the holiday season. There, on Saturdays in August, 100,000 passengers—a number somewhat greater than the whole population of towns like Burnley, Grimsby, or Northampton—may arrive by rail, composed of day, half-day, and period ticket-holders. On a Saturday during the "Illuminations Weeks," 90,000 to 100,000 passengers reach Blackpool by rail, the vast majority after 2 p.m., and practically all of them require to return the same night.

Camping Coaches.—Railway camping or caravan coaches were introduced in 1933, and have become steadily more popular each year. There are now 427 of these vehicles which are placed in sidings up and down the country, including the Lakes, the Peak District, the Scottish Highlands, seaside resorts, and other holiday districts.

The coaches, which accommodate six or eight persons, are fully equipped with cutlery, bed and table linen, crockery and kitchen utensils, folding arm-chairs, heating stove and cooking-stove, and other requisites. Fresh supplies of bed and table linen are provided through railway hotel laundries each week, and the coaches are placed within easy access of water supplies.

Chapter IV

RAILWAYS AND THE TRADER

The development of the railways transformed trading conditions in this country. Transport at speeds previously unattainable became a commonplace, thus opening up new branches of trade, such as that in perishable produce over long distances, and in the older trades greatly increasing efficiency by facilitating the distribution of their products. Rail transport also proved itself very suitable for the carriage of bulk commodities at low rates, thus cheapening and improving the transport of the raw materials of industry. Moreover, as a result of amalgamations, and the introduction of a clearing house system, together with organized collections and deliveries, the railways were able to provide a nation-wide system of transport, whereas formerly transport tended to operate mainly in local areas, where numerous small operators worked largely independently of each other. The canal companies, even though the area of their operations was largely confined to the region between the Thames, Humber, Mersey, and Severn, never evolved a clearing house system, a through toll system, or any degree of standardization. Few

canal companies acted as common carriers, and the actual carriage of commodities was left in the hands of independent carriers known as by-traders. Unlike the railways, the canal companies do not provide for the collection and delivery of goods at their wharves.

The development of railways made it possible for traders to carry smaller stocks, and yet to rely on the certainty of these being replenished at short notice. The railways became in the nineteenth century the universal common carriers; and the provision of regular, nation-wide transport facilities by the railways transformed the economic structure of Britain's internal trade.

In our own day, the development of motor road transport, together with the services recently provided by the railways to counter this competition, have carried the movement a stage further forward. Traders to-day demand and expect next-day deliveries and the provision of special facilities for traffic passing in small quantities. Retailers work with smaller capital and shorter credit than formerly, though they carry a wider and more varied stock than was usual in the past. As an example of the variety of stock now carried by retailers, it was stated by Mr. Gordon Selfridge, Junior, in a paper read to the Norwich Meeting of the British Association for the Advancement of Science, that in the Stocking Department of Messrs. Selfridge there were by actual count 10,765 different kinds of stockings.

There is hardly a trade which is not affected by the tendency to order in small lots at a time.

Whereas a grocer formerly might have ordered a hundredweight, he now orders a stone; the stationer will now order a dozen where before he ordered a gross; while a chemist may order a single bottle, whereas previously he would not order less than a dozen.

The reasons for these developments are several. The fall in the price level which occurred after 1921 led traders to attempt to protect themselves from the effect of falling prices by carrying small stocks. Fluctuations in consumer demand have become more frequent; fashion changes, for example, are now spread over a much greater part of the community than in pre-war days, and the demand for new designs, novelties, or fashion goods is now much more insistent than formerly.

These modern tendencies are reflected in the consignments of merchandise traffic sent by rail, which have very definitely tended to go in smaller consignments. Speaking in 1928, Lord (then Sir Josiah) Stamp stated that "the number of consignments of handled traffic per ton appears to be approximately three times what it was before the war." Subsequently, in his Annual Speeches as Chairman of the L.M.S.R., he has frequently alluded to a continuance of this tendency.

Such changes in the nature of the traffic handed to the railways have greatly increased the difficulty and expense of handling traffic, though they have been offset to some extent by improvements in terminal or goods shed equipment and by improvements in handling methods. Thus, it has been stated that on the L.M.S.R. the

average time occupied in handling 100 tons of traffic in 1933 was 128 man-hours as compared with 136 in 1923.

Modernization of Depots.—During recent years, considerable attention has been paid to the modernization of goods depots and terminals. Traditional methods have been re-examined with the object of increasing efficiency and adapting working methods to modern conditions. Such investigations offer considerable scope, as conditions are now very different from what they were in the past. Mechanization is one possibility. Man-handling and human porterage are necessarily very expensive when computed on a tonnage basis, especially now as wage rates are considerably higher than in pre-war days and an 8-hours day is in operation. The difficulties of introducing mechanical equipment lie in the miscellaneous nature and the varied sizes of consignments, together with the irregular flow of traffic.

Successful and important experiments, however, are being carried out with wagon unloading-machines and slat conveyors, while mechanically-propelled barrows are now fairly extensively employed. Experiments along the lines of " time and motion studies," which have been widely adopted in manufacturing industry, are also being made with a view to eliminating double handling, wasted efforts, or unnecessary movements. More is also being done in the direction of direct transference between railway wagons and road vehicles, as this cuts out the dumping of consignments on

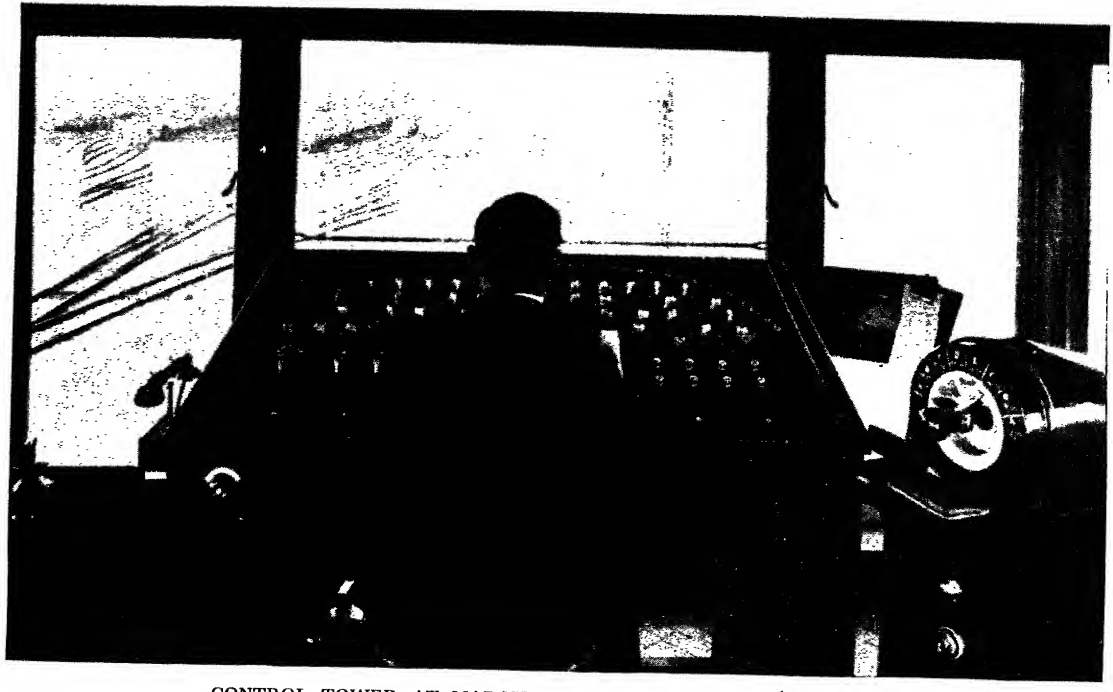
the shed bench and their handling for a second time. The layout of a number of goods terminals has been entirely remodelled to facilitate rapid handling, and improved artificial lighting has been effected in numerous depots, marshalling yards, and sidings which enables wagon labels, delivery advices, and other documents to be more easily read.

Express Freight Trains.—The greatest improvement during recent years has been the speeding up of freight trains. Express freight trains are now run throughout the night between all important centres, which allow of a late afternoon collection of goods in one town and next-day delivery at their destination. Working timetables have been revised and many trains are scheduled to cover more than 100 miles without a stop. The fastest freight trains are composed entirely of vehicles fitted with continuous vacuum brakes, like passenger trains, and this enables them to be scheduled at average speeds of 45 m.p.h. Without continuous brakes such high average speeds would be impossible as the train could not be drawn up in time between the sighting of an adverse "distant signal" and the stop signal which it precedes. There are now in service 72,000 goods vehicles which are vacuum-fitted, and the number is being increased each year. Every 24 hours 661 freight express trains are run as compared with 338 some five years ago. Terminal organization has also been improved by the concentration of traffic for a particular area at one station, from which it

is delivered to its destination by road motor services.

Railway Services.—The ideal of railway goods operation is that all consignments should be delivered at their destination station, wherever it may be, the day after dispatch. Traders have a right to demand that this should be the aim of the railways, but if it is to be attained they have on their side a responsibility of so organizing their dispatch, packing, and labelling, as to facilitate the work of the railways. Goods should be handed over to the railways as early as possible in the afternoon, and not at the last moment. Railway collecting lorries should not be kept waiting, and packing should be devised to facilitate handling. Labels should be clear, definite, and secure: this is not always the case, and particularly with some of the newer packing materials, such as fibre-board, old labels are often allowed to remain on the packages. Co-operation between traders' organizations and the railways by means of area consultative committees would be a valuable aid in connection with these and other matters.

Complaints, for example, are often made by traders, some reasonable, some unreasonable, some justified and some unjustified, about details of railway charging, journey times, or loss of goods in transit, delays, and the like. The quality of the service given to traders depends largely on individual members of the railway staffs, and in a large organization some individuals may adopt a "take it or leave it" attitude towards traders



CONTROL TOWER AT MARCH MARSHALLING YARD (L.N.E.R.).
This is a modern mechanized yard with accommodation for 10,500 wagons.

or may not exert themselves sufficiently, while others are unsparing in their efforts to meet the needs of particular traders or to get traffic through to its destination.

In a large organization, where the staff is scattered over a wide area, there is an obvious danger that apathy, indifference, and traditionalism may spread among members of the staff unless endeavours are made to counteract these tendencies.

There appears to be a need for the introduction of regular channels for consultation between the railway companies and the traders. More also might perhaps be done to enlighten traders as to railway operating difficulties or as to the expense involved in providing certain facilities. For example, though railway posters are used with considerable effect to advertise passenger travel, they have so far only been employed to a limited extent to interest the trader in the advantages of co-operation between the railways and the traders. In the U.S.A., the New York Central Railroad makes a feature on its public time-tables of " Hints to Shippers," which explain the advantages of mutual co-operation between traders and the company.

Organized consultation between traders' associations and the railway companies would provide machinery for investigating complaints, clearing up misunderstandings, and the like. This might be achieved by reviving interest in the local Railway and Traders' Committees, which were established in 1923, and it is of interest to

note that the Association of British Chambers of Commerce has urged its members to stimulate interest in these bodies. In addition, it might be desirable to appoint area public relations officers whose aim would be to secure and retain the goodwill of traders and the public. The introduction of a public relations department under the direction of an individual known by name to the public would encourage them to believe that somebody in the railway cared whether a train was late, a consignment mislaid, or an article damaged in transit. Moreover, it should have a stimulating effect on the railway staff, encouraging enterprise and imagination, especially if the public relations officer passed on any " bouquets " received from members of the public to the individual members of the staff concerned. In the comparable field of Post Office enterprises, the introduction of a public relations department has had excellent results.

New Developments.—In catering for the needs of modern trade, the railways have developed ancillary road services to a considerable extent and these have greatly increased the flexibility of the services which can be offered. New developments include railhead services, extended use of containers, development of rural lorry services, and mechanization of cartage services.

Railhead services have proved especially attractive to traders engaged in national distribution, as the system enables them to consign goods in bulk by express goods trains at low rates, and to distribute goods in retail quantities from the

railhead depots by road. Warehouse accommodation can be hired from the railway companies, who are prepared to deliver the goods as and when required. The railhead depot system combines the advantages of rapid transit in bulk by rail with the flexibility of road transport distribution in small quantities.

In the towns, cartage boundaries have been extended to meet changing requirements and considerable progress has been effected in the mechanization of cartage services. Motor tractors (called mechanical horses) have been employed on a large scale in place of horse vans or lorries, and there are now some 4,000 mechanical horses in use. The conditions under which collections and deliveries are effected, however, differ considerably in different areas, and in some districts the use of horse vehicles still proves more economical than motor vans or tractors. The railways find useful employment for about 25,000 horse vehicles and some 11,000 horses; the disparity between vehicles and horses being explained by the fact that a horse or motor tractor can be used to haul another vehicle while one is unloading.

Bulk Traffics.—Though the general trend in retail trading has been in the direction of smaller consignments, there has been a trend in the opposite direction for certain kinds of traffic; but this is in connection with wholesale and industrial traffics rather than retail distribution. Notable examples of traffics which are now sent in bulk loads are: milk, oil, and petrol in tank

wagons; or grain, bricks, steel sheets, limestone, soda ash, and ammonium sulphate, in specially constructed vehicles. Other traffics now frequently passing in bulk include acetic acid, beer, bitumen, caustic soda, condensed milk, formaldehyde solution, glucose, liquid oxygen, printer's ink, silicate of soda, tar, vinegar, and wood oil.

Bulk forwarding of liquids enables considerable economies to be effected in handling and in the capital outlay required as compared with conveyance in small barrels, drums, or other containers. It also reduces the trader's cost of transport, since the traffic is charged at the net weight of the liquid, and advantage can be taken of the rates applicable to traffic carried in tank wagons. Various incidental economies can also be obtained, and loading and discharging operations are simplified. Further, the special wagons now available enable temperature to be controlled to any desired degree, thus permitting the fluidity of certain materials to be maintained, or preserving the quality.

Private Owners' Wagons.—British railways originated in connection with coal traffic, and an important relic of early conditions is the prevalence to-day of the private owner's wagon in the coal trade. There are something like 600,000 private owners' wagons running on the railways to-day, and of these about 90 per cent. are utilized in the conveyance of coal or coke. These wagons belong to over 5,000 owners, though about one-third are the property of wagon-hiring firms;

and their value has been estimated at between 56 and 60 million pounds. The remaining 10 per cent. of private owners' wagons are largely owned by lime companies, iron works, tar distillers, chemical works, or oil distributing companies. Many of them are special types such as tankers, ore hopper wagons, yeast vans, or high capacity wagons.

Private wagon owners cling very tenaciously to their prescriptive rights, largely on the ground that ownership gives the assurance of having a sufficient supply of wagons available at all times (even during periods of seasonal pressure or trade activity), as the wagons cannot be loaded by any one else and must be returned when empty. The collieries and coal factors, who use their wagons to store coal, also claim that it is an advantage to have wagons waiting under load to be sent away as required. No charges are incurred if the wagons are in private sidings, and if they are in railway sidings only siding rent is charged, amounting to 6½d. a day, whereas if railway wagons were utilized demurrage charges would have to be paid on wagons kept beyond the free period. In many trades there is a publicity value in having wagons lettered with the name of the firm, and the wagons can be constructed to suit the special needs of the trader's traffic. Retail coal dealers who buy coal in small quantities and hawk it through the streets or sell locally from a small office have their coal delivered by rail in hired wagons, from which they load their road vehicles as required.

These prefer small wagons as they may only discharge about 5 tons a day, and they dislike the fact that the 8- or 10-ton capacity wagon is now being ousted by the 12-ton type. In their view the smaller wagon is the better as they do not order big stocks, and with small wagons can avoid siding rent by unloading within the free period. Privately-owned wagons while not in service on the railway systems are available for "internal user" without payment, and this may be important in gas works, steel plants, or other works where materials have to be moved from one part of the works area to another. An exception to private ownership of wagons in the coal trade is to be found in the Durham and Northumberland coalfields where all the wagons are supplied by the L.N.E.R. In the Kent coalfield the wagons are also railway-owned; while in Scotland the proportion of railway-owned wagons is considerable.

Not only in connection with the coal trade, but with traffic in ores, limestone, other minerals, and basic materials, open type private owners' wagons are extensively employed. The remainder are for the most part special wagons such as oil tankers, yeast vans, tar wagons, salt vans, or milk tankers. These are generally expensive wagons, and as in any case they would travel usually between fixed centres there are no great disadvantages from the railway point of view in their being owned by traders.

The ordinary open type of wagon of the now standard size of 12-tons capacity costs about

£150 to £200, but usually the wagons are hired either on simple hire terms or on hire purchase. To finance hire purchase, there are several old-established firms which specialize in the business. Some of these concerns, such as the Lancashire Wagon Co., Ltd. (established in 1857) now incorporated in the North Central Wagon Co., Ltd. (established in 1861), date back for seventy years or more. The total capital invested in the wagon-hiring companies exceeds £6,000,000, though few of them now confine their attention to railway wagons, but also finance the hire purchase of locomotives, road vehicles, and agricultural machinery.

Special arrangements can also be made by traders for the repair of any of their wagons which may break down. On payment of a "commuted charge" of 1s. per wagon per annum to the Railway Clearing House the owner is entitled to free haulage and shunting services if the wagon breaks down. Otherwise the owner would be required to pay shunting and haulage charges. To indicate that wagons are entitled to these free services the letters "C.C." are painted in black on a five-pointed star, coloured yellow, above the wagon number on each side.

Most traders owning their wagons have contracts with various wagon repairing companies for the maintenance of their vehicles at a fixed charge per annum. This is indicated by a plate on the wagon, and if at any point on its journey the wagon is found to be defective the repairing company is notified.

With very few exceptions privately-owned wagons are used for "one-way traffic," and on completion of the loaded journey the wagons have to be forwarded direct to the colliery, works, or other specified point for reloading. The individual wagons have to be sorted out, and this involves much extra shunting. Sir Ralph Wedgwood, in evidence before the Royal Commission on the Coal Industry in 1926, stated that out of a total of 23 million freight shunting-hours in 1924, 10 million hours were chargeable against private owners' wagons. Where wagons are railway-owned, there is no need to sort out particular wagons, and further it may be possible to balance empties at one destination with the demand for reloading there or in the vicinity. The savings in operating costs that would be effected by complete common user of wagons have been estimated as being probably between £600,000 and £1,000,000 a year. In some areas, a wagon pooling system, or limited common user, has been adopted whereby any wagon in the pool can be returned in place of returning individual wagons, thus reducing shunting costs, and providing a partial solution of the problem. During the Great War, railway companies were permitted to use private owners' wagons for the conveyance of other traffic so long as it was on the ordinary run as an empty of such a wagon.

Neither common user nor railway ownership would, of course, obviate all empty haulage, as wagons after unloading would have to be placed

in circulation, and empties would have to be supplied to the collieries or other traders.

Yet another defect of the private owners' system is that the wagons are often of small capacity and of varied type. The Royal Commission on the Coal Industry pointed out in 1926 that private owners' wagons were generally of 8-, 10-, or 12-tons capacity, whereas the standard railway-owned wagon for mineral traffic is of 20-tons capacity. Since then, there has been some advance in the standardization of private owners' wagons, and average capacity has risen. The older wagons, of which many are still in use, are often of weak construction, and thus place a limit on train loads.

A large proportion of private owners' wagons are fitted with grease axle-boxes, and this slows down shunting operations, as such wagons do not run as freely as those fitted with modern oil axle-boxes. Also, the grease axle-boxes are liable to overheat, and can only travel on the slower goods trains.

Wagon Capacities.—A characteristic and traditional feature of British railways is the small capacity of the standard mineral and merchandise wagons. The explanation, no doubt, is to be found in a variety of causes, among which the more important would seem to be the small-scale distributive methods of retail trade, the prevalence of private owners' wagons, the short length of the average haul, and the lack of any direct interest on the part of traders in promoting railway operating economies.

The earliest railway trucks as used on the Stockton and Darlington Railway in 1825 were chauldron wagons, which carried four tons of coal, and had a tare weight of about $2\frac{3}{4}$ tons. Since 1825, though progress has been slow, the tendency has been to increase carrying capacity in both volume and weight as compared with the weight of the wagon itself. In the fifties, the ordinary open wagon carried 6 tons, at the end of the century, 8 tons, and in 1912 10 tons. A more progressive policy, however, had been adopted before the war in certain areas or for certain types of traffic. Thus the N.E.R. introduced a 20-ton standard for mineral traffic, and employed 40-ton bogie wagons for certain coal export traffic. A number of railways also utilized 20-ton wagons for locomotive coal traffic, notably the G.W.R. and the G.E.R. In Scotland the Caledonian Railway built over 400 bogie merchandise wagons each of 30-tons capacity.

The 12-ton wagon has now become the standard, and the smaller wagons are now rapidly disappearing. The average capacity of railway-owned wagons has steadily risen from 10.2 tons in 1921 to 11.8 tons in 1936.

In other countries the average wagon capacity is a good deal higher than in Great Britain—*e.g.* $15\frac{1}{2}$ tons in Belgium, 16 tons in Germany, and $42\frac{1}{2}$ tons in the United States.

The more general adoption of 20-ton wagons for mineral traffic in this country would appreciably reduce the cost of handling such traffic, besides increasing railway efficiency in other

directions. It has, indeed, been authoritatively estimated that the universal adoption of 20-ton wagons for coal traffic would permit a reduction in freight charges of from 5 to 10 per cent.

One of the main advantages would be a reduction in the proportion of rate weight to carrying capacity, with a consequent saving in locomotive power. Other advantages would include a considerable saving in the capital cost of constructing wagons, a reduction in the amount of shunting required, and a reduction in the length of trains, with an incidental saving in the extent of siding accommodation required.

According to the report of the Royal Commission on the Coal Industry, a 20-ton wagon, as compared with a 10-ton wagon, shows an increase in tare weight of only 30 to 50 per cent., though its carrying capacity is 100 per cent. greater. The capital cost of construction is only about 50 per cent. greater; maintenance charges show a saving of about 25 per cent.; the length is only from 16 to 30 per cent. more, while locomotives can haul a paying load greater by about 25 per cent.

Put in another way, this means that a train-load of 600 tons of coal would require 60 wagons if 10-ton trucks were used, involving a gross weight of some 975 tons with a train length of 1,170 feet, whereas if 30 wagons of 20-ton capacity each were used the gross weight would be reduced to 907 tons and the length to 690 feet. If 40-ton wagons were adopted only 15 wagons would be required, and the train length would be further

reduced to 591 feet. The gross weight, however, would only be slightly reduced, since such wagons require to be of the bogie type.

Though the advantages of the 20-ton wagon are most apparent in the coal trade, especially where export traffic is concerned, there are many other types of traffic, such as ores, road-stone, bricks, grain, iron and steel products, and crude chemicals, which could be advantageously conveyed in high-capacity wagons, especially where the traffic flows in well-defined directions. Between Fletton and London, 50-ton trucks, with drop sides, carrying 19,800 bricks each, have been in use for some years past. Sulphate of ammonia from Haverton Hill to Middlesborough is also conveyed in 50-ton wagons, while recently the L.M.S.R. has built a number of all-steel wagons of 16-tons capacity for conveying soda ash in bulk.

Where capacities exceed 20 tons, bogie wagons are generally essential. This entails a greater unladen weight, and the proportion of carrying capacity to tare weight does not appreciably improve until a capacity of something like 50 tons is reached. The bogie wagon has not been very extensively adopted for mineral traffic on British railways, mainly because on sharply-curved sidings the overhang may be so great as to prevent the wagon taking the curve. Considerable variations in the size of wagon also lead to difficulties in marshalling yards, as, for example, where hump-shunting is employed.

The prevalence of the private owners' wagon

in Great Britain has greatly complicated the problems connected with the universal adoption of 20-ton wagons in the coal trade. In general, colliery owners are reluctant to adopt high-capacity wagons on account of the expense involved in purchasing or hiring the wagons and in altering coal screens, weigh-bridges, siding layouts, or other plant. Furthermore, hoists, tips, and other appliances at the ports would have to be altered in many districts. Together with the alteration of certain works sidings to enable them to take larger wagons, the total cost involved in such reconstructions has been estimated at £8,750,000. Objections are also sometimes raised in this country against high-capacity wagons on account of the alleged greater breakage of coal, though experience in France, Belgium, and Germany would seem to disprove this contention. It is now generally agreed that the 20-ton wagon is the most suitable for the coal export trade, and its adoption has been strongly recommended by the Royal Commission on the Coal Industry (1926), the Standing Committee on Mineral Transport (1929), and the Royal Commission on Transport (1931).

For general merchandise which passes in relatively small quantities and requires a frequent, fast, and punctual service, there is practically no demand for wagons of a capacity much in excess of the standard 12-ton wagon. The average loading of these wagons with general goods is not much over 3 tons, as the cubic capacity of the goods may prevent better loading and wagons

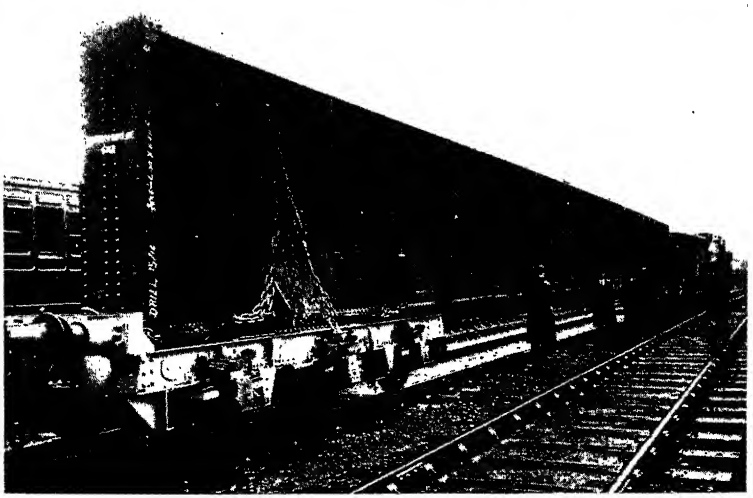
may have to be dispatched direct even if not fully loaded. A 12-ton wagon could be fully loaded with 8 tons of loose potatoes, 3 tons of short deals, $2\frac{1}{2}$ tons of empty beer barrels or 6 cwt. of empty pottery crates. Road competition and the trend of modern trading conditions have combined to impose on the railways the necessity of providing rapid transit and quick deliveries. The small British merchandise wagons are undoubtedly expensive to operate, yet it is difficult to foresee any wagon larger than 15 tons becoming a practical proposition in this country for the carriage of general merchandise.

British railways are the only important systems in the world which have retained the loose-link coupling for freight trains. In France, Belgium, Germany, Switzerland, Canada, the U.S.A., and Japan, for example, either screw couplings or automatic couplings are employed. Air-brake equipment is now general abroad, and this makes it possible to run freight trains at higher speeds, since the whole train can be braked instead of only the engine and van. Express freight trains in this country operated with specially-fitted wagons are now, of course, air-braked, but the mineral and slower freight trains are not. The addition of air-brakes to wagons would increase the weight by about half a ton, but the main objection to the use of air-brakes in Great Britain, where hauls are short, is that it would cause serious delays at reception sidings and marshalling yards, and such delays would largely offset the increased running speed on short hauls.

Types of Wagon.—A railway requires a wide variety of wagons to meet the requirements of particular types of traffic. The most usual type to be seen is the high-sided, open wagon of 12-tons capacity ; many of these are fitted with end or bottom doors for handling coal traffic. The open wagons are utilized mainly for coal and mineral traffic, but for general merchandise the box type is preferred. The box type does not require sheeting, which is necessary if general merchandise is to be carried, and sheets are seldom quite impervious to rain or snow. When mixed classes of goods are carried a larger bulk can be carried in box wagons, as the sides are higher. On the other hand, an open wagon can be loaded by cranes, and lengthy or awkward goods such as agricultural machines or implements, rails, timber, or poles, can be more easily loaded into open wagons. Both open and box wagons are required, as they fill separate needs. In all, the railway companies own some 646,000 wagons, and of these some 570,000 are ordinary wagons of the open or covered type. Only a comparatively small number, namely, about 45,000, are of 20 tons or over in capacity ; the proportion of these high-capacity wagons has been increasing considerably during recent years, as ten years ago only 25,000 were in service. There are about 16,000 cattle trucks, 23,000 rail or timber trucks, and some 13,000 brake vans ; while there are 50,000 special wagons of very diverse types for the carriage of special traffics, including horse boxes, fish vans, banana vans,

ventilated or insulated vans, glass wagons, carriage wagons, scenery wagons, elephant wagons, grain trucks, and tank wagons. Fleets of wagons are available for out-of-gauge or exceptionally heavy loads (including one owned by the L.N.E.R. which has 56 wheels and can carry a concentrated load of 110 tons, or, if necessary, 150 tons). Flat bogie wagons are employed to carry unusually long articles such as telegraph poles, ship's masts, propeller shafts, or 90-ft. rails. Well-wagons which bring the load within a few inches of rail level are utilized for heavy electrical machinery, granite blocks, pulleys, anvil blocks, or castings; while bridge girders, up to 120 ft. in length and 11 ft. in height, are transported on twin girder wagons, in which the girder becomes part of the wagon while being conveyed. Where traffic is out-of-gauge, special arrangements may be made for Sunday working, when both lines are kept free and the load is allowed to overhang on the 6-ft. way between the two tracks. Sometimes even signals and other track-side obstructions may be removed to facilitate the passage of exceptional traffic.

During the past two or three years experiments have been made in providing shock-absorbing wagons for conveying glass, carboys of acid, concrete pipes, and other articles particularly liable to damage. The L.M.S.R. now has some 200 of these wagons in service, each of 12 tons capacity. They have been designed after extensive research and experiment, and incorporate a special springing system which entirely absorbs



OUT-OF-GAUGE LOADS.

(*a*) Train-load of boilers, Waterloo sidings, Leeds.

(*b*) 70-ton girder, 111 feet long, on twin trucks, the girder forming part of the wagon.

normal shocks and ensures the safety of the goods carried. The G.W.R. has also introduced a number of shock-absorbing wagons in which the body is entirely self-contained and moves independently of the underframe, which is fitted with special springs and buffers to absorb shock. Under test, a shock-absorbing wagon was shunted ten times into other wagons at varying speeds up to 14 m.p.h., and its load of toys, glassware, and other light goods suffered only minor damage.

Registered Transits.—It is now possible to register consignments sent by rail under what is known as the " Green Arrow " or " Blue Arrow " systems. The former applies to merchandise or livestock sent by merchandise train, and the " Blue Arrow " service to traffics consigned by passenger train. Immediately a consignment is registered, it is brought under a special control system whereby every railway contact point *en route* receives an advance advice by telephone or telegraph of the transit, and a constant watch is maintained until the consignment is delivered at its destination. Special " green arrow " or " blue arrow " labels serve to identify the consignments. The registration schemes are particularly useful for specially urgent consignments such as spare parts required for machinery repairs, articles sent to catch sailings of ships at the last moment, or loads in connection with which the consignee has to arrange for staffs to be available on arrival. The fee charged is 2s. 6d. per consignment, whether a single article, a wagon load, or even a train load.

C.O.D.—Another facility which has become available since 1935 is "cash on delivery" services. Consignments up to £100 in value can be sent C.O.D., and the method is used extensively for rubber tyres, motor car and engine parts, furniture, machinery, or for quick replacements.

Warehousing.—All the main line railway companies provide warehouse and storage accommodation on a large scale. In the cities and larger towns substantial and well-equipped premises are provided for the purpose, while even at the smallest country station facilities are available, by means of adapted railway vans (known as "mobile warehouses"), which can be moved about the railway system as required. To illustrate the extensive scale on which warehousing and storage is undertaken by the railways, it may be mentioned that in Manchester alone the L.N.E.R. store upwards of 20,000 tons of traffic, 2,000 pipes of wine (about 750,000 gallons), over 3,000 cases of spirit, and 500 tons of dutiable goods in bond. At the five L.M.S.R. goods stations in Manchester approximately 60,000 square yards of covered accommodation are available for letting or storage, and practically the whole of this space is occupied.

Chapter V

RAILWAYS AND THE FARMER

The farmer, like the manufacturer, is dependent on cheap and efficient transport in order to reach his market and to obtain materials such as feeding stuffs, grain, or fertilizers. Low transport rates are especially important to the British farmer, as he has to compete with foreign and Empire produce sent by sea in bulk at low rates. Commodities such as wheat, wool, meat, or fruit, can be brought very cheaply to this country from Canada, the U.S.A., the Argentine, New Zealand, or South Africa, and can generally be sold at prices below those ruling for home produce. Overseas produce arrives in shiploads, and can be railed from the ports to London and other large cities in full train or wagon loads at less cost than is involved in moving local produce collected in small lots over a wide area. From time to time examples are cited of alleged preferential treatment to consignments of foreign meat, cheese, butter, fruit, or vegetables. It is alleged that lower rates are granted by the railway companies to the importer. The home grower is naturally aggrieved when he is charged a substantially higher rate per ton than the im-

porter. The lower rates are available to the home grower, it is true, but he cannot take advantage of them because he cannot comply with the conditions as to quantity. A case of this kind, which attracted much attention in pre-war days, was the granting of a special rate of 25s. a ton to American meat carried from Liverpool to London. The railway company, in reply to criticisms, stated that the consignments were large and regular and that if a higher rate had been charged the traffic would have been consigned direct to London by sea. The home farmers, on the other hand, it was pointed out, only sent their meat in small, irregular consignments which involved much trouble and expense in handling. Similarly, the L.S.W.R. was attacked because it granted lower rates on foreign meat landed at Southampton than those charged to West Country farmers. The Company's defence was that a single vessel arriving at Southampton brought sufficient chilled or frozen beef to make up a train of thirty wagons, each holding on an average three tons, and this train could be taken straight through to London from Southampton. Fresh carcasses, on the other hand, were consigned from numerous West Country stations, each dispatching one, or two, or, at the most, three wagon loads, and, moreover, they had to be carried suspended from hooks in ventilated vans.

Methods of packing may also influence cost to the railway; thus foreign butter is packed in strong wooden boxes of a uniform size which

can be loaded so as to provide a full wagon load, whereas home produced butter may be consigned in hampers, cardboard boxes, or wooden boxes of varying size, which are not strong enough to load in several tiers.

The cost of transporting agricultural products is often considerably greater than that of industrial products owing to the nature of the traffic, but, because they are bulky in proportion to weight, are of low value, or have to compete directly or indirectly with imported produce, the farmer demands low rates.

Agricultural Requirements.—Agriculture makes several special demands on transport that distinguish it from most other industries. Many forms of agricultural production are seasonal in character, so at one period of the year transport facilities may be severely taxed to cope with the demand, while at other periods the demand may be non-existent. Much agricultural produce is highly perishable, and therefore express transit is essential ; refrigerated or insulated vehicles, too, may be required. Certain types of fruit and vegetables must be marketed in the minimum of time after picking, as otherwise the " bloom " is lost and the produce will not obtain the best prices.

Agricultural products frequently require special facilities which are not necessary for ordinary factory products. Livestock, for example, requires special handling ; soft fruit has to be loaded with exceptional care ; and empty baskets or churns have to be returned.

One of the outstanding features of British agriculture is that the vast majority of farms are quite small. There are some 467,800 farms in Great Britain, and of these (excluding rough grazings, mountain, or heath lands) two-thirds are under 50 acres, while only 3 per cent. are over 300 acres. Clearly, British farming is not in any way comparable to large-scale factory industry. Moreover, the products raised in British farms are very diversified. There are seven main farm crops—wheat, barley, oats, hay, potatoes, sugar beet, and roots for stock; and five main types of livestock—beef-cattle, milk-cattle, sheep, pigs, and poultry. These involve a large variety of marketable products for most of which specialized transport facilities may be necessary: mature beef, veal, and stores; milk, butter, cream, and cheese; fat sheep; fat lambs, stores, and wool; porkers, baconers, and stores; and eggs and poultry of various kinds. In addition, there are about a score of vegetables and a dozen fruits which are of commercial importance. There are, moreover, frequently different qualities of each product which suit them to different markets, while the same product may come on the market at different times from different areas, *e.g.* soft fruit, potatoes, and other vegetables, or flowers; thus necessitating a movement of vehicles from one area to another.

It is not, of course, anything unusual for an industry to turn out a variety of commodities, but in agriculture as many as twenty or more products may be reared or cultivated on a single

farm, and, because farms are small, their output may consist of very small quantities of a fairly large number of products. The transport requirements of the farmer, therefore, are difficult and expensive to provide. In general, also, British farmers will not co-operate in marketing their produce, though this might provide a means of securing some economies through bulk loadings and standardized packages.

Road Services.—Road transport has abstracted much agricultural traffic from the railways over short and moderate distances, as the road vehicles can be sent direct from the farm to the market. Motor transport has brought isolated farms, hamlets, and remote villages into ready communication with the towns, and, indeed, it might well be said that rural life has been transformed since the war by the agency of motor transport.

Realizing the advantages of direct farm delivery and collections, the railway companies have developed a widespread system of motor lorry services in rural districts. Operated from some 2,750 railway stations, their road services link up the farms and villages with the railway system. No longer need the railway be regarded as something many miles away, for the railway lorries now come to the farms, even though they may be as far distant as twenty miles from the nearest station. Specially constructed lorries are provided to carry various descriptions of agricultural traffic, such as milk, livestock, hay, or straw. In connection with milk traffic, the rail-

way companies have adopted a practice, common with road hauliers, of erecting stages at convenient points, on which farmers may place their milk churns to await the arrival of the lorries and where returned empties are left.

Originally intended to serve farms previously without regular transport facilities, the services have been extended to cater for parcels, merchandise, shop deliveries, road stone, or timber, as well as agricultural requirements and produce.

Arrangements can be made for storage or warehousing at railway stations, and for the delivery of the goods by motor lorry as required.

The railway rural lorry services are of two main types : (*a*) scheduled services operated over fixed routes, and (*b*) contract services for full-load traffic, such as might be required by a farmer at harvest time. Goods are carried either all the way by road or as part of a combined road and rail service.

Farm Removals.—In connection with the road services, comprehensive removal services have been developed during the last few years. Complete farms can be removed from one district to another, including the cattle, horses, pigs, chickens, and other livestock, farm implements, and machinery, portable outhouses, household furniture ; incidental services such as the laying of linoleum and carpets or the hanging of pictures are also performed. Where the removal is a large one, a special train is provided, and the trucks and vans are placed at the farmer's dis-

posal at the most convenient time, usually after the evening milking. The train is then worked through to reach its destination in the early hours of the following morning. One such special train was provided to remove a farm from Lincolnshire to Scotland. In all, fifteen wagons were required to accommodate five horses, thirty-one cows, and thirty calves, together with various farm implements. Three household removal containers carried the farmer's furniture and that of his workers, while a steam-heated passenger coach was provided for the farm personnel. After a late afternoon start, the journey of 300 miles was completed early the following morning.

Another example, of which details have been given by the British Railways' Press Office, is that of the removal to a new farm, fifty miles away, which was carried out by rail in a few hours. " A special train was chartered carrying three container loads of furniture, eight vehicles of farm implements, one horse-box, and four cattle wagons for fourteen milking cows, nine store beasts, one young bull, one horse, forty head of poultry, one dog, and four cats. The farmer and his family slept in their old home on the night prior to moving; the cows were milked at the ordinary time; the family breakfasted at 6.0 a.m., and lunched at the destination station at 1 o'clock. The cows were installed at their new quarters ready for milking again at 4.0 p.m., the family were sitting down to tea at their customary time after the milking was done, the unpacking was finished, the carpets were down, pictures and

curtains were hung, the china stored away and bedsteads put up for the night's rest."

These farm removals are carried out in one operation, and thus, especially as rapid transit is afforded, impose the minimum interference with the farm routine. There is no necessity for the farmer to dispose, probably at a loss, of any of his stock or implements before leaving his farm.

Agricultural Shows.—Special arrangements are made by the railway companies in connection with agricultural shows. These include the arrangement of cartage services for transferring exhibits between the nearest railway depot and the show grounds. Lifting power for loading and unloading is provided by mobile cranes with capacities up to six tons or by smaller run-about petrol cranes. Special numbered trains are operated, and arrangements for the return of livestock are drawn up in consultation with the exhibitors. Offices, in the charge of experienced staffs, are set up at all the principal shows, where advice and assistance on all transport matters can be obtained. Show properties and unsold exhibits are accepted for conveyance at half rates on the return journey.

Special Services.—The railways also operate a special service to enable farmers to ascertain without delay the existence of any movement restrictions imposed by the Ministry of Agriculture in any part of the country.

Yet another special service whereby the railways assist the farmers is the provision of grain sacks for hire. A very large stock, numbering

many hundreds of thousands of sacks, is maintained, and consignors of grain by rail can obtain the use of these sacks for thirty days at a charge of one penny per sack per journey.

Livestock Services.—On the railways, special provisions are made for the carriage of livestock. Special wagons are provided which can be run on passenger or fast freight trains, and experienced staffs are employed to deal with this traffic. The wagons are free from all interior projections, even bolt heads being countersunk and corners rounded off so that animals may not be injured. Pens and other accommodation are provided at the majority of country stations to ensure the safety and well-being of the animals. Feeding and watering of the animals, when needed whilst in transit, is undertaken by the railway companies, and, in order that the staffs looking after livestock may know when the animals need attention, special labels are fixed on livestock wagons showing where, and at what time, the animals were last fed and watered. Milking cows are specially cared for when travelling long journeys, and the railway companies arrange for milking (if this becomes necessary before destination is reached), so that unnecessary suffering may be avoided. The guards of all trains conveying livestock make periodical examinations of the wagons containing animals to ensure that all is well, and there are strict instructions regarding attention to fallen animals. Further inspections are made at all important stations at which the trains may stop. All rail vehicles, road vehicles, and accommoda-

tion at stations for livestock are scrupulously cleansed and disinfected under strict supervision.

Though the amount of rail-borne livestock traffic has been decreasing since the peak year of 1927, when 19.7 million head were carried, it is still between nine and ten million head per annum. In 1913, about 19½ million head were transported by rail, but since then the growth of road transport has abstracted much of the short distance traffic. In 1936 over 2½ million head of cattle, over 5½ million sheep and lambs, over two million pigs, over 300,000 calves, and over 33,000 horses were conveyed by the railway companies.

A recent important development has been the extension of road services for livestock. The railways now have large fleets of low-loading road vehicles specially designed to handle livestock traffic. Farmers and dealers are disinclined to transfer stock from one vehicle to another, and the greater part of livestock traffic handled by the railway companies' road vehicles is conveyed by road throughout. Where there is sufficient traffic, double-deck vehicles of 3-ton capacity are provided. The companies have also fleets of motor horse-boxes containing 2, 3, or 4 stalls. These vehicles are mainly used for direct road transport over short or medium distances, and have proved very popular for transporting horses to the various race-courses. By arrangement, the railway companies are prepared also to undertake droverage on behalf of dealers or butchers.

Animals are carried at owners' risk, but they may be insured against death or injury during

loading, unloading, and transit at premiums ranging from 1d. to 8d. a head, irrespective of the distance carried—the scheme applying to calves, sheep and lambs, porkers and bacon pigs, cattle, horses and ponies.

Chapter VI

SPECIAL SERVICES

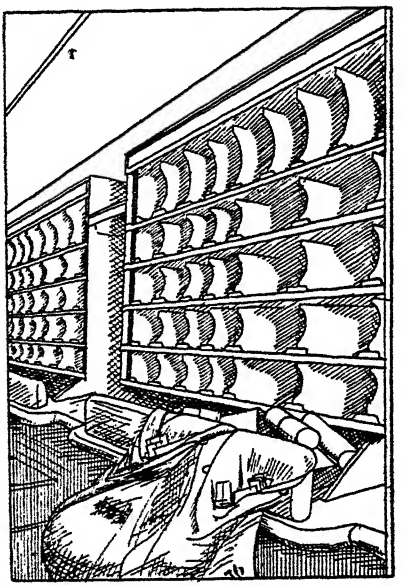
Post Office Services.—Postal services in this country are very largely dependent for their efficiency on the facilities provided by the railways, and almost from their inception passenger trains have been utilized to convey mails ; the first rail-borne mails being carried between Liverpool and Manchester in 1830. No considerable acceleration in the mails was obtained until the trunk railways were built, but with the completion of the Grand Junction Railway in 1837 (connecting Manchester and Liverpool with Birmingham), and of the London and Birmingham Railway in 1838, the advantages became marked. In 1837 Frederick Karstadt, the son of a post office surveyor, suggested that further time might be saved if letters were sorted *en route.* His scheme was taken up by the Grand Junction Railway, which inaugurated the first travelling post office on January 6, 1838, between Birmingham and Liverpool, utilizing a converted horse-box for the purpose. Later in the same year, the company built a special sorting carriage, which was equipped with apparatus for collecting and dispatching mail bags while the

train was travelling at speed. This exchange apparatus was designed by John Ramsay, a post office official, and, though improved in 1848 by John Dicker, it was substantially the same as that in use at the present time.

Special mail trains were first inaugurated in 1855 by the G.W.R. between London and Bristol. In 1885 the famous "special mail" express between London and Aberdeen was introduced over the systems of the L.N.W.R. and the Caledonian Railway, being a development of a previously existing service between London and Preston. This "West Coast Postal" has the distinction of being the longest train in the world devoted entirely to post office business, as it now operates regularly with thirteen or fourteen bogie vans; some six of which are sorting vans fitted with exchange apparatus.

To-day, the whole of Great Britain is covered by a network of travelling post offices. Almost every main line has a night mail over the whole or greater part of its length, and there are also several day mail services. In all there are some 70 special mail services, and approximately 165 specially constructed carriages are used, of which 90 are fitted with apparatus for exchanging mail bags with the 116 apparatus stations at present working in Great Britain. Each year some 500 million letters and packets are carried in the various travelling post offices which cover annually some 4 million miles, and some 500 postal officials are daily employed in sorting this huge mail while travelling. In addition, millions

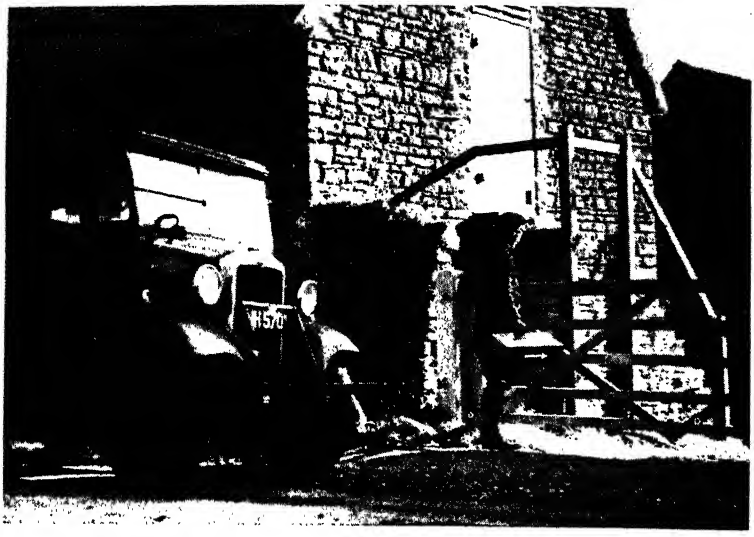
of mail bags and parcels are carried on ordinary passenger trains. In all, the railways handle annually more than 6,000 million letters (being 80 per cent. of all the letters posted in this country), and 150 million parcels.



A travelling Post Office, showing holes for sorting letters.

Under their contracts with the post office the railway companies provide all the necessary sorting vehicles and stowage vans, the latter being used to convey mail bags which do not require sorting *en route*, or which have been made up on the journey. Mail vans are fitted at both

Facing page 113.



THE RAILWAYS COME TO THE FARM.

Regular road services to farms and villages are now provided from some 2,750 railway stations.

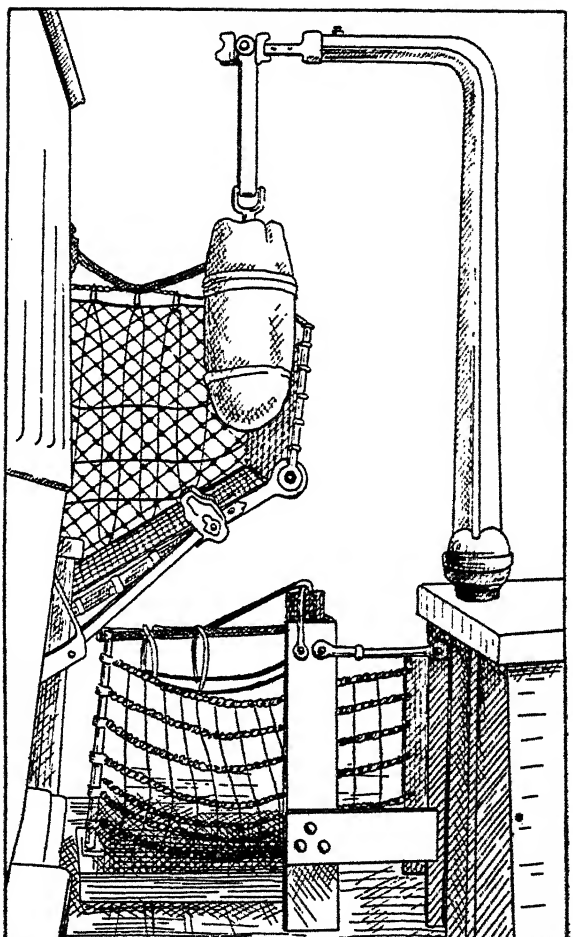
ends with gangways to give through access, and they are equipped with various amenities for the staff, including, in the more modern types, wardrobe cupboards and electric urns for tea-making. In a sorting van one side is occupied with pigeon holes for sorting the letters; these pigeon holes being arranged in groups of appropriate sizes for registered letters, small letters, long letters, newspapers, and packets. Below the pigeon holes, there are sorting tables covered with green baize or linoleum. On the other side of the van, rows of iron pegs are provided for suspending bags into which the sorted letters have been placed according to destination. The fronts of all shelves, tables, and peg-rails are covered with horse-hair padding to protect the staff from minor injuries. The men engaged in sorting are especially skilled, and usually average a rate of 42 letters a minute as compared with a general average over the whole country of about 30 letters a minute, and this despite the greater difficulties of the conditions under which they work.[1]

A specially interesting feature of the working of the travelling post offices is the arrangement for the dispatch and receipt of mail bags while the train is travelling at high speed, maybe 70 m.p.h. or more. For this purpose, special leather pouches are used weighing 20 lb., which may be loaded with mail bags up to 40 lb. in weight. The total weight of 60 lb. must not be exceeded, however, as otherwise the impact

[1] Viscount Wolmer, *Post Office Reform.*

might be too violent. The pouch is slung on an arm outside the sorting van and is received by a net fixed at the side of the track. For delivering pouches to the trains, a reverse procedure is adopted ; the pouch is hung on a special hook, which is turned into the working position just before the train is due, and is caught by a net extended from the side of the van. Up to nine pouches may be collected by a mail train at one working, while as many as 20 can be delivered from a train into a net of the largest size. The working of the line-side apparatus demands both nerve and strength on the part of the responsible post office officials, and men are therefore only appointed to such positions after passing a special test for physical fitness.

The operators inside the sorting van often note their position by sound, particularly at night-time. Within a mile or so of the point of dispatch special doors are opened, and at the appropriate moment indicated by the passing of a special signal board, or some line-side mark such as a house or bridge, the carriage net is opened out, and the delivery arm is extended. It is essential that the operations should be performed quickly, so as to reduce to a minimum the time during which the apparatus projects beyond the side of the van. As a rule the complete operation, including the opening of the carriage net, the extension of the outgoing pouches from the train, and the exchange of pouches, is accomplished in twelve seconds or less. Very special precautions are taken to ensure safety in working.



Collecting a pouch in the net of a passing train.

The arm in front of the carriage net is used to deliver a pouch into the line-side net.

The British postal service functions so smoothly that probably few members of the general public realize the work that is involved behind the scenes in providing next-morning deliveries in all parts of the country, or in handling millions of letters in a single night. In this work the railways play a vital part, for as Sir Evelyn Murray—Secretary to the Post Office—has said, "the postal service is ultimately dependent upon rail transport, and from the post office standpoint the train service provided by the British railway system is extremely good." [1]

Perishable Traffics.—The transport of highly perishable articles over long distances is only possible if refrigerated, insulated, or ventilated facilities are available. Increasing attention has been devoted during recent years to problems of refrigeration, and much scientific research has been undertaken by the Railway Companies. As a result, considerable progress has been made in providing improved services for foodstuffs, which are now the more essential as some years ago Public Health Regulations were introduced which prohibit the use of preservatives formerly commonly employed.

The main problems which have been tackled are (1) the determination of the most suitable refrigerants and the best methods of application, and (2) the determination of the best means of constructing and insulating the vehicles employed in carrying perishables.

Two types of refrigerant are now in general

[1] *The Post Office*, p. 39.

use, namely, ordinary ice, usually designated "water-ice," and a preparation of solid carbon dioxide known as "dry ice." This latter has the very low temperature of minus 109 degrees Fahrenheit, and when employed it enables traffic to be transported at very low temperatures.

Water-ice refrigeration is provided on rail vehicles, either by ice contained in rustless metal bunkers fitted in the roof of the vehicles, or else by placing the ice in direct contact with the traffic, *e.g.* wet fish packed with ice in boxes. Dry ice may be carried in cardboard boxes hung under the roof of the vehicle or in fixed bunkers fitted into or under the roof.

The quantities and type of refrigerant required and its method of application depend on the nature of the traffic, the temperature at which it requires to be kept, the prevailing air temperature outside the vehicles, and the length of time the traffic is in transit.

A great variety of traffics are now carried in insulated or refrigerated vehicles, including fresh, chilled, and frozen meat, cooked and preserved meat, sausages, frozen, dried and fresh fish, bacon, rabbits, game, milk, cream, ice-cream, cherries, strawberries, raspberries and other soft fruits, liquid eggs, and cut flowers. The bulk of home-produced foodstuffs requires refrigeration only during the summer months—approximately May to September—but for certain commodities it is beneficial even during the winter months.

Refrigeration for perishable traffics has great advantages, and the extra cost of the service is

generally more than offset by the increased prices which can be obtained in the markets for produce in the best condition. The goods are safeguarded from any risk of deterioration which might result from sudden change in temperature. Further, new markets may be developed, since refrigeration makes it possible to reach the more distant centres from remote regions. Hampshire strawberries can now be sent in refrigerated containers to Liverpool, Leeds, Newcastle, and Glasgow, while ice-cream from London, formerly only sent as far north as Newcastle, can now be sent to Aberdeen and Inverness. Where goods are collected from, or consigned to, premises not connected with private sidings, the railway companies can provide special insulated containers which prevent any break of insulation on the journey. They are especially suitable for chilled meat, frozen fish, and similar commodities; while ventilated containers can be provided for fresh carcasses, fruit, etc. Many of the ventilated and insulated containers have special hanging apparatus, while some of the insulated containers have dry ice bunkers. Great advances have been made recently in the insulating efficiency of rail vehicles or containers as a result of research carried out with the collaboration of specialists and government research departments.

Home-produced meat passes in large quantities by rail, and express services are operated from the producing areas to London and other large cities; special trains being run when necessary.

These trains are scheduled at high speeds, and there is, for example, a daily service leaving Aberdeen at 9.45 a.m. which enables fresh meat to be delivered in Smithfield Market shortly after midnight. Much of the meat traffic travels in specially constructed containers of the ventilated type. These containers are equipped with bars and hooks for hanging short sides of beef or carcasses of mutton.

Milk is another commodity which is conveyed in very large quantities by rail, and much has been done during the last few years to extend and improve the transport of milk. Glass-lined milk tanks, each holding 2,000 to 3,000 gallons of milk, and large milk vans carrying hundreds of churns, are conveyed by express trains to London and other important consuming centres.

Vegetable and Fruit Traffics.—Each year, some 2,500,000 tons of fruit and vegetables of all descriptions are conveyed by rail from the growing areas and the ports to markets in all parts of the country. The production of certain vegetables and fruit is largely localized in specific areas, and it is thus possible to make special arrangements for handling consignments during the busy season. Plums are produced, for example, in large quantities in the Vale of Evesham. The fruit is picked when ripe, and, as next-morning deliveries are essential, special trains are operated to all parts of the country. The traffic is concentrated into a short season, and during the peak period as many as 400 wagons may be forwarded in a single night from one of the main

forwarding stations alone. Packing varies according to the type and hardness of the plums, and the methods utilized include bags, pots, hampers, trays, bushels, and chips. The fruit must be carefully stowed in ventilated fruit vans for working on express freight trains, and it is usual to place the packages end to end not more than one tier high. To secure prompt clearing of the traffic and expeditious delivery, it is essential that the details should be carefully planned in advance. Specially printed circulars are therefore sent out to the growers, advising them of the latest times at which their produce should be handed to the railway to secure delivery at destination next morning. Some growers bring their plums to the station on their own or hired vehicles, while others utilize the company's motor lorry service. Many of the smaller growers put their packed fruit on roadside stands from which it is collected by the railway motor lorries.

The cultivation of forced rhubarb is another highly localized industry, confined to a small area of the West Riding of Yorkshire. The rhubarb is tied up in bundles and packed in light boxes. Forced rhubarb is highly susceptible to damage, and its freshness depends on packing being delayed to the last possible moment. To meet the requirements of the growers, special arrangements are made for last minute collection, and express through trains are operated to London and the large provincial cities.

Strawberries present a specially difficult transport problem, as they ripen during the hottest

part of the year, and this very fact means that they deteriorate quickly. The special problem, therefore, with this traffic is to provide very rapid transit to market for delivery a few hours after picking. Most of the traffic goes in handle or chip baskets holding but one or two pounds of fruit, and thus its importance cannot be judged by its weight alone. The quantity of traffic forwarded is governed by seasonal conditions, but, to give some idea of the traffic, it may be mentioned that in 1937 some 5,000,000 packages were forwarded by rail from the various growing districts. In order to ensure that the traffic will be worked through with maximum efficiency, temporary railway control offices are set up in the fruit-growing districts during the season. Refrigerated services in insulated containers using dry ice have become increasingly popular for strawberry traffic, as is witnessed by the fact that the number of chips carried by the railways by refrigerated services in 1937 was double that of 1936 and treble that of 1935.

Similarly with raspberry traffic, refrigeration is especially valuable, research having shown that the principal requirement is rapid cooling of the fruit to a temperature of 45 degrees Fahrenheit. The main producing areas for raspberries are Perthshire, Angus, and Fifeshire, where 6,000 acres are under cultivation. Kent, with a growing area of 2,000 to 3,000 acres, is the principal centre of cultivation in England. In 1937, approximately 7,000 tons of raspberries were conveyed by rail from the Scottish areas

alone. The railway companies provide augmented cartage facilities during the season, and at Blairgowrie in Perthshire contact is maintained with growers daily by a supervisor who controls all the cartage arrangements.

Potato growing is an important agricultural industry; some 600,000 acres being devoted to this crop and a yield of some four million tons being obtained annually. Much of the production is consumed locally, but there is considerable movement by rail to the larger and more distant markets, the average distance for which potatoes are conveyed by rail being 150 miles. The main centres of cultivation are around the Firths of Forth and Tay, Yorkshire, Lancashire, East Anglia, Cheshire, Nottingham, Lincolnshire, and Huntingdonshire. Seed potatoes are produced mainly in Scotland, and during the spring as many as 150,000 tons may be sent to all parts of England and Wales. In the handling of potato traffic, special precautions have to be taken to prevent damage from frost during severe weather, while it is also necessary to prevent over-heating, which is equally harmful.

The railway companies make special arrangements for handling potato traffic, and these may include loading, sorting, checking, and delivery. Wagons are concentrated at key points so that vehicles may be available at short notice, and special trains are run to the main markets when necessary.

Storage facilities are available, and these are extensively utilized by merchants who obtain

their supplies in bulk, often considerably in excess of immediate market requirements. Potato markets are provided at the larger railway depots, and hundreds of thousands of tons of potatoes pass through these annually.

Fish Traffic.—Efficient distributive facilities are of paramount importance in the fishing industry owing to the highly perishable nature of the commodity. The usual trade practice is to auction the fish on behalf of the boat owners immediately it is landed at the port, and it must then be dispatched in the shortest possible time. Special fish vans are worked by express passenger trains or special trains each afternoon or evening from all the main ports to London or other markets so that delivery may be given in the early morning. In London the fish trains commence to arrive before midnight, and deliveries are effected at the markets by 5 a.m. From Fleetwood, for example, a train leaving at 6.5 p.m. arrives at Broad Street at 1.13 a.m., whence delivery is made to Billingsgate Market. From Aberdeen, fish consigned to London, 540 miles away, can be dispatched at 1.55 p.m. to arrive at Broad Street at 3.20 a.m. next morning, and thus be in good time for the Billingsgate market. Similarly, express fish trains are run from Grimsby, Hull, Milford Haven, and Penzance daily, all the year round. More than 4,300 special fish vans are in use for the conveyance of fish traffic, which amounts to some 430,000 tons a year, and these vans have to be returned promptly to the ports so that sufficient

vehicles may be available for the next day's requirements.

Methods of preservation during transit are of especial importance, and these have recently been considerably improved. As a result of investigations carried out, for example, in conjunction with the trade associations of Fleetwood, the permanently ventilated vans which were formerly used for the carriage of fish from that port have now been converted to the closed type.

Over long distances practically all fish traffic goes by rail, but over medium and short distances, road transport offers keen competition.

The fishing industry is especially important to the L.N.E.R., which serves Aberdeen, Grimsby, Hull, Yarmouth, and Lowestoft, and, in addition, some twenty or more smaller fishing ports, which together account for something like 70 per cent. of the total fish landed. Grimsby is the largest fishing port in Britain ; indeed, it is one of the largest in the world, and from it express trains are run to all parts of England, the traffic averaging about 190,000 tons per annum. On the L.M.S.R., Fleetwood and Aberdeen are the most important, the former being owned by the company.

Herring fishing presents special problems as it is seasonal. During the early part of the year all the fishing is off the north-west of Scotland, the catches being landed at Scottish ports. In the autumn the herring fleets move southwards to fish in the North Sea, and during the last three months of the year the herrings are landed chiefly

at Yarmouth and Lowestoft. Herrings undergo a number of different processes before they are sold. Some are packed in ice for dispatch to London and other cities for sale as fresh herring, but the greater part of the catch is cured and exported to the Baltic. There is a good deal of long-distance travel by rail done by the fishermen, especially during the summer months when Lowestoft boats are working from Scottish ports, special reduced-rate fishworkers' tickets being available for men on leave. Between two and three thousand Scottish " fisher lassies " follow the herring fleets from port to port in connection with the curing of the fish. Special trains at reduced fares are provided, and special fares are in operation from nearly every fishing village. Thousands of tons of coal are brought by rail to the ports for the steam trawlers and drifters, as are large consignments of salt required for curing. There is also an important traffic in fishing nets when the drifts are fishing in distant waters, and special rates are in operation, as the traffic is highly competitive with road transport.

Chapter VII

SOME PROBLEMS OF RAILWAY OPERATING

The Working Time-table

In arranging the train services, many considerations have to be taken into account, including the convenience of the public, the timing of the trains, accommodation at stations, yards, or depots, provision of rolling stock and locomotives, and the duty rosters of guards and drivers. All these involve special consideration, and they have often to be balanced against each other before the arrangements can be completed. Economical working has to be arranged for rolling stock and locomotives, and duty schedules should be such as will fully utilize the 8-hour shifts of employees without incurring overtime.

Passengers require that services should be provided at reasonable intervals, though these intervals will necessarily vary with the length of the journey. For short distance journeys a very frequent service is required. For medium distances up to about 50 miles an hourly service usually suffices, while for long journeys of over

A WORKING TIME-TABLE.

Station.	Distance from A.		1 Engine and Van.	2 Mixed.	4 Passenger.	4 Goods.	5 Passenger.	6 Passenger.	7 Passenger.	8 Passenger.	9 Passenger.	10 Mixed.	11 Passenger.
	M.	Ch.	T.O.								*		
			a.m.	a.m.	a.m.	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.
A dep.	—	—	6.45	8.55	11.41	12.0	3.28	3.36	4.40	6.46	7.35	7.40	8.35
B „	1	52	....	9.0	11.45	12.6	3.32	3.40	4.44	6.50	7.39	7.45	....
C „	4	17	....	9.7	11.51	12.35	3.38	3.46	4.50	6.56	7.45	7.52	8.42
D „	5	33	....	9.11	11.55	12.55	3.42	3.50	4.54	7.0	7.49	7.56	....
E arr.	7	8	7.0	9.16	12.0	1.5	3.47	3.55	4.59	7.5	7.54	8.1	8.49

NOTES:

T.O. Thursdays only.

* When mixed runs, as 10. (A mixed train is one conveying both passengers and goods.)

Dotted lines signify that train passes station, but does not stop.

Heavy type signifies passing times (inserted to guide drivers).

100 miles four or five services a day at well-arranged intervals are generally ample. On particular routes, the frequency of the services has to be related to the public demand, since the receipts from passengers carried by the trains must at least cover the special costs involved in running the train.

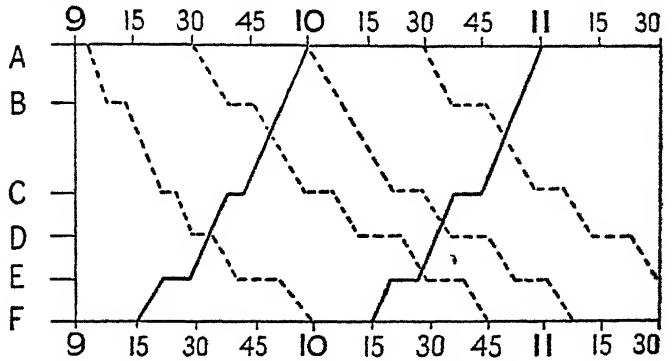
The working time-table is of the utmost importance in railway operating, as on its adequacy and competent planning depend the service given to the public, the efficient use of locomotives and rolling stock, the economical working of trains, and the avoidance of delays to traffic. Train services have to be planned out many weeks before they are put into operation and detailed in the " working book " for the guidance of the staff. This shows the complete timing and description of every ordinary train, and it differs from the ordinary time-table issued to the public in that it shows all trains—goods, mineral, light engine working or service trains, as well as passenger trains. It also gives the passing times at certain points for the information of the drivers and signalmen. Details differ as between different companies, but the example on page 127, based on the working of a branch line of one of the groups, will serve to illustrate the method.

Another system used in preparing working time-tables is the diagram method, in which stations are spaced according to distance from top to bottom of a rectangle, and hours and minutes from left to right, as in the following example :

THE RAILWAYS CARRY COAL.

Coal marshalling sidings at Cardiff, G.W.R.

Facing page 128.



NOTE.—Up and down trains can be shown on the one diagram, but the two must be distinguished so that conflicting movements may be avoided at junctions.

——— Down trains. ..... Up trains.

Trains moving in the same direction must not cut each other except at stations or passing loops. A train standing at a station is represented by a horizontal line, while the inclination of a line between stations indicates the average speed of a train.

The working time-tables of British railways have grown up with the railway systems, but they are subject to constant improvements and have also to be changed from time to time as traffic changes. To meet public requirements it is essential that constant watch should be kept on traffic needs. An alteration to one train may have far-reaching effects, both on trains working on the particular section and even on those in distant parts of the country.

Each week it is customary also to bring out an "Advice of special train and other arrangements," notifying any alterations in the working of ordinary trains during the week, the running of any special or relief trains, permanent way alterations, strengthening of ordinary trains, and similar matters. Special circulars may also be issued in connection with holiday traffic or specific events.

Interval services—whereby passenger trains are run at definite intervals of, say, ten minutes, half an hour, or an hour—have many advantages, especially on electrified suburban routes; being easily memorized, they are popular with the public and generally serve to increase traffic. The main difficulty is fitting in long-distance trains with local services. For example, the ultra-fast express trains now operated on some routes have to be given two sections clear ahead, in place of the normal practice of one section clear ahead.

The success of the working time-table, when translated into practice, is to be measured by the degree of punctuality attained by the trains. Punctuality is of the greatest importance from the point of view of railway operating, since a late arrival on the part of one train may react on all those following it. The delay may be felt for hours after the train has gone on its way, and it may eventually affect trains in distant parts of the country. Connecting trains may have to be "held," waiting the arrival of a late train, though it is usual to dispatch these if the train

is more than a certain number of minutes late. An efficient system of *reporting* late trains is necessary, so that connecting trains are not held up to the limit of the allowable margin without the connection being effected after all. Thus, if the margin were five minutes and the train reported were twenty minutes late, the connecting train should be allowed to proceed on time without waiting the five minutes. Train reports are also necessary to enable platform occupation and drivers' or guards' workings to be arranged to meet the altered conditions.

If trains are habitually unpunctual, they ought to be re-timed. All cases of late arrival should be investigated and the cause ascertained, so that steps may be taken to avoid delays from similar causes in the future. The mark of an efficient railway is a high punctuality record, and where there is a good *esprit de corps* among a railway staff all grades will make every endeavour to secure punctual working. Much depends on the staff, and in certain areas everything is done to make up lost time compatible with safe working, but in other areas, while the men will work the trains within the allotted times, they will do nothing to make good lost time. Some drivers, for example, with a late start of five minutes, will bring their train in exactly five minutes late, no more, and no less; while at some stations, if five minutes are allowed for platform duties, that full five minutes will be occupied.

Punctuality is seriously affected at certain times by untoward events. Thus, bad weather

causing greasy rails may slow down trains, especially at stations or on gradients. Traffic also fluctuates, and station duties may occupy a longer time or trains may be heavier. Permanent way slacks due to repairs may also at times make it difficult to work to schedule.

Modern Signalling.—In various directions, modern developments in signalling have done much to increase operating efficiency. The aim has been to facilitate the passage of traffic in every possible way, to increase the capacity of the line, and to reduce the cost of signalling, though at the same time maintaining, or even increasing, the high standard of safety provided under the block telegraph system in the past. The essential feature of all railway signalling systems is that only one train is allowed to be in any section on the same line at the same time. In the block telegraph system, each block section is under the control of a signal box which is in telegraphic communication with the box in front, and the box behind. The "home" signal in each section (at which trains must stop if it is at danger) is preceded by a "distant" signal, which has a fish tail end and is coloured yellow, and shows an orange light at night. If this is at the "caution" (*i.e.* in the horizontal position), the train must slow down, and be prepared to stop at the "home" signal. If in the meantime the line is cleared, the train would be unnecessarily delayed, so the modern practice is to give a more complete indication by means of three-aspect systems, whereby each signal acts

as both a caution and a stop signal, thus affording continuous information to drivers as to the state of the line ahead. Automatic methods of signalling have further enhanced the possibilities of multi-aspect working, since they enable trains, on sections where there are no junctions, to signal themselves. Automatic signals are operated electrically by means of a track circuit, and are kept at danger behind a train until it has passed out of the section. A distant signal indication is also worked automatically in conjunction with the stop signal. The outstanding advantage of automatic signalling is that it enables the number of block sections to be increased, thus speeding up train movements without necessitating the expense of installing and working extra signal boxes.

With colour light signals, four aspects can be shown, namely, green, clear ; double orange, be prepared to find next signal at caution ; orange, caution ; and red, stop. The four-aspect system has, however, only been adopted by the Southern Railway where it is employed to facilitate the working of dense suburban traffic.

Electric colour light signals of the searchlight type are used for both night and day operation, and they provide a long range indication by means of a concentrated beam which can be seen at 1,200 yards even in strong sunlight, and have great penetrative powers in fog and mist. Increasing use is now being made on all the British railway systems of electric colour light signalling, and in time it may be expected that it will become practically universal.

Progress is also being achieved in the power operation of points, and in many modern signal boxes the manual levers which required considerable strength to operate are being replaced by miniature levers operating electric circuits. One power-operated signal box can often do the work of two or three manually operated boxes, since points can be operated at a greater distance than the maximum of 350 yards which is enforced when manual operation is employed. Time is also saved in working the levers, and this enables signalling operations to be expedited.

Fog has particularly serious effects on train working. Special time-tables have to be prepared in advance and a number of trains are taken off. Fog signalmen are called out, and the position of the signal arm is indicated to the driver by the use of detonators and large flags or hand lamps shown by the fog man. Recent developments in signalling have done much to improve train working in fogs, as the newer type of signal which employs coloured lights instead of a semaphore arm can be distinguished at 200 yards in fog. Where such signals have been installed fog men are not required. On some lines where colour light signals are provided even ordinary working may be continued during fog, and there is no doubt that the best public passenger services during fog are provided by such services. During recent years, in heavy fog, some of the electrified suburban systems have maintained almost normal services while bus services have had to be withdrawn altogether. The most effective solution

to the problem of fog working is provided by automatic train control, whereby the position of each signal on passing is indicated to the driver by either an audible or visual signal in the engine cab. The G.W.R. has now extended its system of automatic train control over the whole 2,840 miles of main-line routes from Paddington to Penzance, Fishguard, and Chester. Some 2,900 locomotives are equipped with this device, which consists of a contact shoe on the engine and an insulated contact ramp on the ground between the rails near the " distant " signal to which it applies. If the distant signal is at " clear " an electric bell is sounded in the engine cab, but if it is at " caution " a syren is operated. On the L.M.S.R. and the L.N.E.R. experiments are now being carried out with the " Hudd " system of automatic train control, which is worked by electro-magnetic induction. The L.N.E.R. is putting in its installation between Edinburgh and Glasgow, on which section a collision between two passenger trains took place during a snowstorm in December 1937. As with the G.W.R. system, automatic train control of the Hudd type is at present being applied only to " distant " signals, and includes an automatic brake application if a warning sounded on approaching an adverse signal is not acknowledged by the driver. Automatic train control has from time to time been recommended by government committees and in the reports of official investigations into railway accidents. Though admittedly the adoption of automatic train

control is expensive, it would advance a step further the great record of safety in working which is held by the railways.

The Carriage Roster.—A problem of considerable importance in the efficient operation of passenger train services is that of providing the necessary coaching stock, which must be of a suitable type for the particular train, and must be available where and when required. Passengers naturally complain if insufficient carriages are provided; if the proportion of first class to third class is not suited to their needs; if non-corridor stock is run on long-distance trains; or if dining-cars, sleeping-cars, or buffet-cars are not available at suitable times. The difficulties involved in the provision of carriages are of considerable magnitude, though they are seldom fully appreciated by passengers. Much care and foresight have to be expended in compiling the "carriage roster," which describes the composition of each train and the work which is to be done by each set of carriages during the day. The essential problem is to meet the convenience of the travelling public, but at the same time to secure the maximum possible useful mileage from the carriages each day. The first consideration in preparing the carriage roster is as far as possible to keep the carriages in sets, though on local services traffic variations throughout the day often make it difficult to achieve this ideal. Long-distance express trains, such as "The Coronation," "The Royal Scot," "The Southern Belle," or "The Cornish Riviera Ltd." are usually made

up of special stock and do not need to be varied. Suburban trains are generally made up in sets of carriages permanently coupled together, though electric trains are usually divisible into two parts of, say, three or four coaches each, so that half may be left in a siding between the peak hours. As far as possible, especially with steam trains, the breaking up of sets and subsequent re-forming is avoided, and it is only done when a clear advantage is to be gained. Traffic working must, if possible, be balanced, since it is clearly uneconomic to run empty stock trains, or to operate long trains for a mere handful of passengers.

The ideal of economical and balanced working is that the *whole* of the traffic should be carried in the smallest number of carriages. The prevention of unbalanced working can only be attained by experience, constant experiment, and careful supervision of the work. It involves also close collaboration between the officials concerned in the making up of the carriage roster and their colleagues who are responsible for the preparation of the working time-table.

The actual form of the carriage roster differs to some extent as between the different companies, and either a numerical or a diagram method may be used. An example of the numerical method is given on page 138.

Where a set returns by the same path to the starting point as it travels on its outward journey, it is described as a " shuttle " or " back over " service. If the return is made by a different

THE CARRIAGE ROSTER.

Train Set 760.	Working 420.			Notes.
	From	To	Time of Arrival.	
Empty 7.25 a.m.	A Sidings	Station B	7.40 a.m.	
Loaded 8.0 a.m.	Station B	Station C	10.15 a.m.	Detach one bogie carriage.
„ 11.15 a.m.	Station C	Station D	12.15 p.m.	
„ 2.5 p.m.	Station D	Station C	3.10 p.m.	Add one bogie carriage.
„ 5.5 p.m.	Station C	Station B	7.25 p.m.	
Empty 7.40 p.m.	Station B	A Sidings	7.55 p.m.	

route, the system is called " circular " or " circuit " working. Shuttle working is well suited to routes where traffic is considerable and fairly evenly balanced throughout the day, or for branch-line working. Sometimes, as in the example of a carriage roster given above, shuttle working is of a compound nature. Simple shuttle working has the advantage that the stock can be suited exactly to the needs of the route.

The main difficulty in arranging circular working, and to some extent compound shuttle working, is that the train sets may not be well suited to all the routes served. Train sets may work the same " turn " day after day, or they may be used to work a number of trains in rotation. In the latter system, the train set is said to form one of a " link " of sets ; the link com-

prising all the sets used on these turns of duties. The number of train sets employed in a link may vary from one to twenty-five or more sets.

A hundred miles a day in traffic is usually regarded as an efficient average of carriage running, but this figure is not easily attained owing to traffic variations. Coaching train-miles per train-hour is the test applied to check the efficiency of the carriage rostering, and during the busier months an average of about thirteen or fourteen coach-miles per train-hour is obtained, though on long-distance non-stop routes a figure of forty-five to fifty coach-miles per train-hour is reached.

Since traffic fluctuates from month to month and from year to year, it is essential, periodically, to check the number of passengers travelling on particular trains. This is done by means of a traffic census, which is compiled by actual inspection of trains. The census will serve to show if the accommodation is suited to the traffic.

A special problem is presented by holiday, excursion, or other special traffic. Traffic at such times is generally unbalanced, and there may be no alternative but to send forward empty stock trains at night to the large towns or holiday resorts. The provision of adequate stock, especially on bank holidays, is a difficult problem. Obviously the companies cannot provide stock which would only be used for a few days a year. To meet the situation, repairs may be held back till after the holidays, while just before the holiday peak period overhauls may be pushed forward.

Sometimes it is possible to get an extra run or two out of the sets already in use, though this may involve the rearrangement of half a dozen sets before an extra journey is obtained from a single set.

In meeting the traffic needs of holiday periods or that created by special events such as race meetings or cup finals, it is essential that everything should be planned in advance. The passenger manager, therefore, keeps a diary of special events, and the amount of coaching stock which may be required is forecasted on the basis of past experience and from information received from various sources.

Diesel Traction.—In several countries abroad, Diesel or heavy oil engines, somewhat similar to those now commonly employed for motor buses or heavy lorries in this country, have been successfully adapted to rail requirements. Diesel rail-cars or trains have set up new standards of express speed in Germany and the U.S.A. at levels which were unthought of even a few years ago. The first ultra-fast Diesel rail-car to be introduced was the "Flying Hamburger," which, in regular service between Berlin and Hamburg, averages 77.4 m.p.h. in one direction and 76.3 m.p.h. in the other, over a distance of 182 miles.

In Britain, Diesel units have proved less attractive than in other countries, owing to our plentiful supplies of cheap coal, and owing to the fact that operating conditions are different. In this country, distances are comparatively short, traffic is heavy, main lines are congested, and thus there

are fewer opportunities for the employment of this form of traction. The express Diesel services in other countries compare somewhat unfavourably with the ordinary express steam train, except in the matter of speed, as on them accommodation is strictly limited, dining car facilities are restricted, space for luggage and parcels is curtailed, and discomfort may arise from vibration and fumes. To some extent these drawbacks which were very evident in the earlier models are now being gradually overcome. The tendency to-day is towards the employment of trains driven by separate power units which incorporate luggage and parcels vans, while passengers are accommodated in carriages independent of the locomotive framework. In this way the effects of noise, vibration, and fumes are overcome, and greater comfort is possible than in the older rail-cars.

In Great Britain, Diesel engines have proved particularly useful for continuous shunting work, mainly because they can be kept working for the greater part of the twenty-four hours. There is a further advantage in that one man only is required to operate them (unless they work outside the confines of a shunting yard). A certain number of Diesel rail-cars have also been introduced by the G.W.R., the L.N.E.R., and the L.M.S.R. The G.W.R. has been the most active of the groups in adopting Diesel rail-cars, and it now possesses a fleet of about forty stream-lined vehicles of this type which regularly achieve speeds of from 60 to 75 m.p.h. The G.W.R.

cars resemble large seaplane floats on wheels, and are fitted with two 130 horse-power heavy oil engines. The latest type can carry as many as 70 passengers, and, if necessary, they can haul an extra carriage or horse-box. Two twin-car units have also been put into service, which accommodate 104 passengers, and were built for serving the route between Cardiff and Birmingham. They are provided with buffets and toilets. An interesting innovation in 1936 was the introduction of a parcels car, operating between London, Oxford, and Reading. This picks up parcels at various stations and thus obviates delays to ordinary passenger trains. The experiment has been very successful and a further vehicle is to be put into service.

The L.M.S.R. is at present experimenting with a stream-lined three-car Diesel train which can reach a top speed of over 80 m.p.h. The three cars are built upon the articulated principle, whereby the middle car shares the inner bogies of the two end cars, thus saving eight wheels. Accommodation is of the saloon type, with reversible seats for 162 passengers ; at each end there is a luggage compartment and a driver's cabin with which the guard is in communication by means of a loud-speaking telephone. As the vehicles are fitted with a " dead man's pedal," which applies the brakes when the driver's foot is removed, they can be driven with complete safety by one man. Air-operated sliding doors are controlled by the guard, and interior heating is provided by boilers which are themselves heated

by the engine exhaust. Floors and sides are insulated to subdue noise, and draughtless ventilators are fitted.

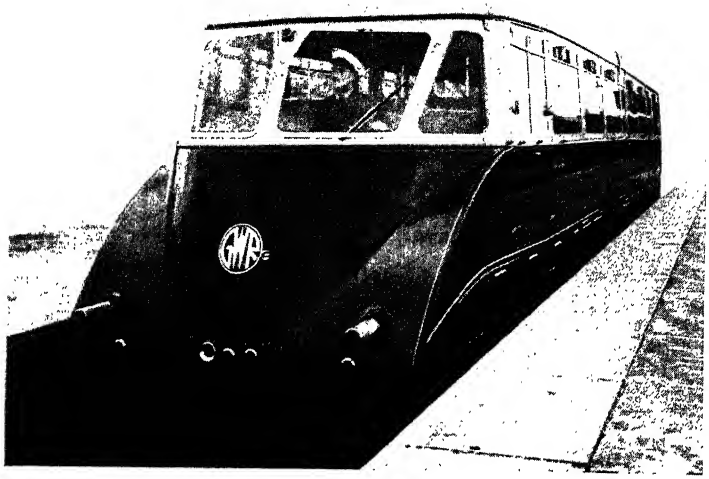
The advantages of Diesel traction are rapid acceleration, high average speed, absence of smoke, reduction in labour costs, and increased availability in service, since less time is required for overhaul or maintenance duties and they spend little time in the repair shops. The Diesel can run up to a thousand miles a day at high speed. On the other hand, Diesel units are more expensive in first cost than a steam locomotive, their weight is greater, and a home-produced fuel cannot be used. The capital cost of a Diesel locomotive is about three times that of a steam locomotive, and in this country it is difficult to find tasks which would use them to capacity. But if they are not fairly fully utilized they will not pay, owing to their high initial cost. As compared with electric traction, Diesel operation is more flexible, and does not require the provision of elaborate transmission wires, electric sub-stations, overhead wires, or third-rail equipment. On the other hand, when intensive services are operated, operating costs are lower with electrification than they are with Diesel operation.

In the U.S.A., Diesel stream-lined trains have achieved considerable popularity, and in 1939 a total of fifty stream-lined trains of this type were in operation. The development has taken place since 1934, and new schedules have been introduced which could not have been performed by

steam locomotives without expensive track improvements. It has not generally been necessary to ease curves or substitute heavier rails, though some improvements to the road-bed have been necessary to ensure safe operation at high speeds. The centre of gravity of the trains is low and the drive is exceptionally smooth, as electric transmission is utilized on all these Diesel trains. Most of the Diesel rail-cars in the U.S.A. have now been replaced by Diesel-electric locomotives which haul trains of light-weight construction. An important development since 1934 has been an increase in the number of cars operated on the trains. At first 3- or 4-car trains were the almost universal practice, but now 10-, 13-, and even 14-car trains are worked. Thus the Seaboard Railway's "Orange Blossom Special," operating between New York and Florida on a route of 1,387 miles in 26¼ hours, has thirteen cars of the air-conditioned, Pullman type, including diners, sleeping-cars, and a lounge-recreation car.

In Germany, the Reichsbahn has definitely adopted a policy of operating long-distance inter-urban services by high-speed Diesel rail-cars. The first of these services, the "Flying Hamburger," a 2-car, articulated unit seating 102 passengers, was introduced in 1933. Now such services are in operation between most of the largest cities.

Electrification.—There are many who advocate the general electrification of British railways, and reference is frequently made to the extent



DIESEL-OIL ENGINES.

(*a*) G.W.R. Diesel-oil rail-car, No. 4, as used for cross-country services.

(*b*) L.M.S. Diesel-oil shunting locomotive, No. 7053. Diesel locomotives well suited to shunting work can be operated continuously over the 24 hours.

to which electrification has progressed in countries such as Switzerland, Sweden, or France. From the point of view of the traveller and the general public, electrification undoubtedly has the great advantage of eliminating the smoke nuisance. The case for and against electrification must, however, be determined largely by the relative costs of operation under different systems of traction. In general, as regards British conditions, it may be said that the economic justification of electrification rests upon the possibility of handling intensive traffic. Only if traffic is heavy will electrification be economically justifiable. In actual practice this will be seen to have determined the electrification policies of the railway companies. Only one company, apart from the London Passenger Transport Board, namely, the Southern Railway, has embarked on extensive electrification, and this is to be explained by the fact that its passenger traffic is very largely intensive suburban traffic; and even the longer routes, such as those to Brighton or Worthing, are partly in the nature of suburban routes. Suburban electrification, as might be expected, has made greater progress in the London area than in the provinces, where suburban electrification has been largely confined to Liverpool, Manchester, and Newcastle-upon-Tyne. Early in the century several of these routes were electrified in order to provide faster and more frequent services. The Liverpool Overhead Railway, opened in 1893, was electrified from the beginning, and was the first overhead railway to be so

operated in the world. The under-river Mersey Railway was converted from steam traction to electric traction in 1903, while the Liverpool-Southport line was electrified in 1904, being followed later by the Liverpool-Ormskirk line. In the Manchester suburban area, the Bury line was electrified in 1916 and the Manchester, South Junction, and Altrincham route in 1931, the latter being the first railway in the country to adopt the 1,500 volt overhead conductor system, as recommended by the Pringle Committee. This is now being adopted for the Manchester-Sheffield electrification, as the third-rail system used in the London area is unsuitable for marshalling yards and freight depots. In the Newcastle area, electric working was adopted in 1904 on suburban routes extending to twenty-eight miles. More recent schemes in the provinces have included the Wirral electrification between West Kirby, Birkenhead Park, and New Brighton, and the South Tyneside route between Newcastle-upon-Tyne and South Shields, which is eleven miles in length and is used annually by five million passengers.

British railways are frequently blamed for not having adopted schemes of wholesale electrification, but the matter is not one to be decided by prejudice or by uncritical generalizations based on inadequate data. It is rather a matter to be determined by economic considerations and relative costs. The electrification of a line requires the expenditure of much additional capital, on which interest has to be earned. Overhead or

third-rail equipment has to be provided, together with the necessary feeders, transmission cables, and electricity sub-stations. The actual cost of running electric trains is, however, less than that of running steam trains. Less labour is required and power costs are less. The extra cost of electrification is very largely a fixed sum per mile, while the savings over steam traction are a definite amount per train-mile. If the number of train-miles run over an electrified section is considerable, then the aggregate savings may more than offset the fixed sum involved in providing the equipment. To illustrate by an imaginary example, suppose that the cost of electrifying a line worked out at £20,000 per mile, representing an interest charge per annum of, say, £1,000, and that the cost of working a steam train were 3s. a mile, while that of an electric train were 2s. 6d. a mile, it would be necessary, before the expenditure on electrification were justified, for more than 40,000 trains to use that mile of line each year; that is, 109 trains a day, or roughly a 20-minute service in each direction over a 16-hour day.

Electrification has certain characteristic features which render it specially suitable for certain kinds of traffic. It has greater powers of acceleration than steam trains, and more rapid braking is possible. Uniform speeds among different classes of trains or over different sections of the line are possible to a greater extent than with steam traction. With multiple unit stock, the trains can be driven from either end, so time can be saved when working in and out of terminal

stations. The number of coaches can be adjusted to traffic requirements, thus effecting a proportionate decrease in power costs, while train speeds can be maintained whatever the length of the train, as each coach carries its own electric motors. These factors make electrification especially suitable to the working of intensive suburban services, and it is in this field that electrification has scored its greatest success. The Southern Railway has made most progress in electrifying its system, and it has now 653 miles of route electrified, compared with 73 route-miles in 1923. It is now the largest electrified suburban system in the world. Electrification has made possible a 70 per cent. increase in the suburban services to and from London in the rush hours. Between 7 a.m. and 10 a.m. on week-days 540 trains are worked into London on the Southern Railway system, carrying 243,000 passengers; and somewhat more than half of these passengers arrive during one hour of the morning rush period.

Electric traction is especially suitable for operating in tunnels, owing to the absence of smoke, and it has the advantage when working over severe gradients, since trains going downhill may be braked by using the motors to generate electric power, which is utilized to provide power for those working uphill. This system of regenerative braking in effect makes each train running on a down gradient a miniature power-station providing energy to a "grid" system. In countries, such as Switzerland, where there

are numerous gradients and tunnels, electrification has definite advantages. Somewhat similar conditions apply on the Manchester-Sheffield main-line route which is now being electrified, as the capacity of the line had reached saturation point owing to the necessity of negotiating the Woodhead Tunnel (5,293 yards long), which is steeply graded. Electrification, it is anticipated, will greatly increase the speed at which trains can be worked through this tunnel; thus increasing the capacity of the whole route between the two cities. All kinds of expedients have been tried to increase the capacity of the tunnel section, such as the installation at one time of a signal-box in the middle of the tunnel, worked by signalmen on special shifts of four hours a day; but, short of driving another tunnel, electrification has been found to be the only solution.

The Steam Locomotive.—Though electric trains and Diesel traction are making rapid progress, the steam locomotive is by no means a back number yet, and locomotive engineers are agreed that there is still great scope for improvement. The steam locomotive is a self-contained power unit and is not dependent on an elaborate and extensive electric equipment. Considerations of national defence are in favour of steam operation, as it would not be put out of action so easily as an electric system dependent on central power stations or oil engines dependent on imported fuel. The steam locomotive is cheaper in first cost than Diesel engines; it is more flexible and simpler in construction. A common delusion is

that higher speeds are possible with electric traction than with steam locomotives, but such is not the case, and if speed alone were the consideration, steam or Diesel trains would be probably better than electric trains. Improvements in the steam locomotive still continue, and the latest steam locomotives, such as "Silver Link" of the L.N.E.R. or "Coronation" of the L.M.S.R., are magnificent examples of the skill of locomotive engineers. For goods and mineral traffic, no other form of rail traction really comes up yet to the steam locomotive, other than in special circumstances.

Marshalling Yards.—The shunting and arranging of wagons involves a heavy cost which, according to an estimate given by Lord Stamp, amounts to over five million pounds for the L.M.S.R. alone. The work is done at marshalling yards, where trains coming in from surrounding stations are split up and reformed into other trains, which provide full loads for a variety of destinations. With few exceptions, marshalling yards have been constructed before the amalgamations of 1923, and they have been designed originally to meet the needs of the previously independent companies. Many of them were already old-fashioned in 1923; others are cramped in their layout because of physical limitations; and yet others have developed in size without regard to operating efficiency by the successive additions of a few sidings at a time to meet the needs of increasing traffic. To-day, the railway companies are confronted with

difficult problems in re-designing inefficient yards, to meet changed conditions brought about by increased wage rates, shorter working shifts, and changes in the nature and flow of traffic. It is essential in the interests of economic and efficient working that this task should be accomplished, and the companies are now engaged on an extensive scale in modernizing their shunting equipment and improving the technique of working.

Marshalling yards are of various types, though they are all designed to perform the same main function, namely, the splitting up and re-forming of goods and mineral trains. Most of the small yards are of the *flat type*, in which the wagons are sorted into the various sidings by the continual backwards-and-forwards movement of the shunting engine over the shunting neck, from which the various sidings branch. In these yards the work is somewhat slow, and the wear and tear on the engine brakes is considerable. *Gravity yards*, where the sidings are on a falling gradient, have the advantage that the engine power required is reduced to a minimum. Edge Hill (Liverpool) and Crofton (near Wakefield) are good examples of this type of yard. The disadvantages are that plenty of space must be available, the contour of the land must be suitable, and additional shunting staff are required to apply and release the hand-brakes on the wagons so that their rate of movement into the various sidings may be controlled.

In a third type, known as *hump yards*, a loco-

motive is used to propel the wagons up the hump, from which they run by gravity into their respective sidings. Hump yards are numerous in Germany, where they have been employed for a long time, and there are also many in the U.S.A. In Britain, examples are to be found at Cadder, March (Whitemoor), Toton, Wath, and Willisden. Hump yards save time in shunting as compared with flat yards, and as compared with gravity yards they can be located where desired without special reference to the contour of the land.

The essential features of an efficient marshalling yard, whatever its type, may be summarized under two main headings. First, adequate reception sidings must be provided for the incoming trains to stand clear of the running lines while waiting their turn to be put over the hump. There should be facilities for the rapid release of train engines. In a flat yard, the best position for the reception sidings is alongside the sorting sidings; with a gravitation or hump yard in tandem with them. They should be of adequate length to accommodate the longest trains, though their number will depend on the rate at which trains arrive as compared with the rate at which they are cleared.

Second, the sorting sidings must be sufficiently numerous to provide a line for each destination for which trains are made up. Special sidings should be provided for brake vans and crippled wagons. If a considerable amount of marshalling in station order is involved, a subsidiary yard may

be required, though in general this is done at the outgoing end of the yard.

The braking of wagons involves considerable expense, since shunters have to be employed to pin down wagon brakes, so that the wagons may not overrun the end of the siding, or collide too violently with others already in the siding. In some of the largest and most modern yards, such as Hull, March (Whitemoor), and Toton, automatic rail brakes are provided, generally combined with a system of centrally-controlled, power-operated points. In these mechanized yards the gradients from the hump are sufficiently steep to allow the slowest running wagons under the worst conditions to run the farthest distance required, the rail brakes adjusting their pressure to the weight and speed of the wagon or cut of wagons. In the Whitemoor yard, the points are set automatically for each cut, and for this purpose a punched card is made out in the reception sidings for the train, and when this card is passed through a machine in the control cabin the points are set automatically in the right sequence.

In modern marshalling yards attention is now being paid to a number of smaller matters which may influence efficiency. Thus the use of light-coloured ballast in the point area assists visibility from the pointman's cabin ; loud-speaker telephones have been found very successful in facilitating communication between inspectors, foremen, and shunters, and new shunting engines are to be provided with duplicated controls so

that the drivers may use either side of the cabin, thus obtaining a better view of the yard.

An important economy would be obtained if shunting engines could be devised to be operated by one man instead of the two men (driver and fireman) normally required. Experiments have been carried out in this direction, the first company to introduce the system being the L.N.E.R., which employed for the purpose Sentinel locomotives of about 100 and 200 h.p. These are light-weight, steam locomotives with high-pressure vertical boilers, similar to those employed in the Sentinel-Cammell rail-cars. More recently the L.M.S.R. has developed the use of higher-powered Diesel locomotives.

Chapter VIII

RAILWAYS AND THE ROADS

The twenty years or so that have now passed since the Great War have seen revolutionary changes in transport. Entirely within this period, commercial air transport has been developed to its present position as an accepted means of regular transport over long distances. Motor road transport has definitely established itself as an essential part of our national transport system, and has almost completely broken down the former monopoly of the railways. Even the canals, moribund for some eighty years, have taken steps towards revival (albeit in a limited sphere). Shipping and the coasting trade likewise have seen revolutionary changes, while the railways have reorganized and developed their facilities along new lines to meet changed conditions and new competitors.

The relation of transport to the State has also been completely recast in the same period. A whole series of statutes of the first importance has been passed which re-defines the attitude of the State to the older forms of transport and regulates the new. This spate of legislation commenced in 1919 with the passing of an Act

which established the Ministry of Transport. In 1921 the important Railways Act of that year completely altered the former methods of railway regulation. In 1924 an attempt was made to regulate traffic in the Metropolis by the London Traffic Act, while between 1926 and 1928 a series of private Acts attempted to regulate competition between tramways and motor buses in the provinces. The Railway (Road Powers) Acts, 1928, granted powers to the four main line companies to operate road vehicles or to invest in established road undertakings. Then followed the Road Traffic Act, 1930, the Road and Rail Traffic Act, 1933, the Road Traffic Act, 1934, and the Road Haulage Wages Act, 1938, which between them extended detailed State regulation over the road transport industry. The London Passenger Transport Act, 1933, set up a Board to take over all forms of public passenger transport in the London area, excluding the suburban lines of the four grouped railways. Finally, a very large number of Statutory Rules and Orders relating to road transport have been made by the Minister of Transport under powers conferred in various Acts.

The rapid development of motor road transport has been one of the outstanding events of the post-war period. The war demonstrated the possibilities of the modern road vehicle, and the availability of surplus army vehicles facilitated the inauguration of commercial road services. Since 1919 the history of motor transport has been one of steady progress. In 1919, there were only

271,000 motor vehicles licensed in Great Britain ; in 1923 the number was well over a million ; in 1928 over two million, in 1934 nearly 2½ million, and in 1938 three million.

This enormous development of motor transport has been due to a realization of the advantages which the motor vehicle possesses for certain kinds of transport work. Its outstanding advantage is its flexibility ; it can go when and where the owner requires ; it is suited to small loads, and can provide direct door-to-door services, while, since the cargo is undisturbed during transit, less elaborate packing is necessary than with rail transport.

Parallel with the development of the motor vehicle and the introduction of methods of mass production, there has been a remarkable improvement in the road system of Great Britain, Efficient signalling has been provided by police constables on point duty or by automatic colour lights.

The new road transport proved to be a very formidable competitor with the railways, and the position was in marked contrast to that of pre-war days when the railways had largely a monopoly of inland transport. The railways were handicapped in that they were regulated by the State, whereas road transport was not; and they were denied powers to operate road transport themselves until 1928. Even then certain restrictions and regulations were applied to railway-owned road transport, *e.g.* charges have to be recorded at appropriate railway

stations or depots, and kept open to public inspection. On obtaining their road powers, the railways set about effecting a degree of co-ordination with established road passenger services by obtaining a financial interest in these concerns, generally to the extent of a 50 per cent. interest. In a few years the companies effected such financial agreements with practically all the large road transport companies, and the railway companies' investments in road passenger transport now amount to about £9,750,000, on which very satisfactory returns are obtained —one of the groups, for example, obtaining about 8½ per cent. on its investment in motor bus companies. Competition, however, still prevailed, and passenger traffic still continued to desert the railways for the road. For a time also the road concerns strenuously attacked what had previously been regarded as a railway preserve, namely, long-distance traffic.

In 1930 the passing of the Road Traffic Act marked the beginning of a new policy which attempted to secure a much greater degree of State control over road transport. This was an extremely comprehensive Act, which laid down numerous regulations regarding both private and public vehicles. The speed limit was removed for private cars, though penalties for dangerous driving were increased. For other vehicles various speed limits were imposed according to their type; that for motor buses and coaches being 30 m.p.h. The most important feature of the Act from the point of view of State

control was the establishment in each of thirteen areas (subsequently reduced to twelve) of new licensing authorities known as Traffic Commissioners. The Commissioners are responsible for the licensing of all public passenger vehicles, and they were granted very extensive regulatory powers. The effect of this Act has been to stabilize passenger road transport services, since the Traffic Commissioners not only have powers to refuse to license particular services, but may also make detailed regulations as to routes, timetables, fares, or number of vehicles. The Act has in effect made passenger road transport a State-regulated monopoly, though it has not led to a contraction in road services, as there has been a fair expansion in the industry since 1931. The two industries have, however, tended each to go its own way, though at first there were some attempts at greater co-ordination, *e.g.* construction of combined road and rail stations and inter-availability of tickets. At the present time, tickets are inter-available on some 2,300 routes, and somewhat over a million passengers a year make use of the privilege.

The 1930 Act did not apply a licensing system to goods vehicles, but this was done by the Road and Rail Traffic Act, 1933, which set up Area Licensing Authorities in the person of the Chairman of the Traffic Commissioners of each area. Goods vehicles are divided into three classes, namely, carriers' vehicles, which require an "A" licence ; vehicles used by firms for carrying their own goods ("C" licences) ; and vehicles used

for a firm's own traffic and also, on occasion, to carry for hire ("B" licences). Strict regulations apply to "A" and "B" licences, which are only granted by the area Licensing Authorities if a case is made out that the vehicles are necessary and that suitable other services are not available —either road or rail.

The licensing system has introduced more uniformity in the road haulage industry, though this industry is neither as well organized, nor operated in as big units, as the passenger road transport industry. Undoubtedly it has tended to limit encroachments on the railways, as they can appear in opposition to the granting of a licence to their competitors. No limitations, however, were placed on the issue of "C" licences, and in this direction the competition has not been lessened.

Competition between road and rail on the passenger side has been fairly well stabilized since 1930, and traffic for a large part has tended to be divided according to distance travelled and relative convenience of the two systems on particular routes. On the goods side, competition is still very keen, and it is mainly to meet this competition that the railways launched their demand for a "square deal."

In regard to goods traffic, the railway companies have proceeded on different lines from the policy they have adopted in connection with passenger traffic. They have adopted a policy of investing only in well established road haulage concerns. Their main aim has

WATERLOO STATION ON A HOLIDAY.

Facing page 160.

been to attempt to win back (or force back, their competitors say) traffic to the rails as far as possible, though where this is not feasible (*e.g.* carriage of livestock) they have established road services of their own. They have also extended their cartage areas, and have substituted a large number of motor vehicles or motor tractors for their horse vehicles. The small three-wheeled tractor known as the mechanical horse has proved very suitable to their needs, and the railways have now 3,946 of these tractors in service. In particular, they have attempted to utilize road vehicles as auxiliaries to their rail services, thus giving the latter a greater degree of flexibility. Among such services, important examples are the rural lorry services, rail-head deliveries, and transhipment motor services, which have been described in earlier chapters. The railways now operate some 10,000 motor road vehicles, ranging from light vans to 12-ton lorries, and including a large number of special vehicles. The greater part of their fleets consists of 2-ton and 4-ton lorries which are used mainly in maintaining the regular collection and delivery services. Special attention is paid to the training of the road motor drivers, and training schools have been laid out by each of the companies for this purpose. The G.W.R. school near Taplow station is especially well equipped, comprising a class-room for instructional purposes, a garage, a special road system—complete with gradients, road junctions, portable lights, and standard road signs —and a specially prepared skidding patch. The

L.M.S.R. has established schools at Cleckheaton, Yorks, Oldham, Sutton Park, and Watford, where lectures and practical instruction are given.

Containers.—Many attempts have been made to devise some method of transport that would combine the advantages of both road and rail transit. Of these, the container has been by far the most successful, and the use of containers has continued to expand year by year since they were inaugurated. The container is a demountable body which can be carried either on road vehicles or on railway trucks, and thus goods can be conveyed from door to door without disturbance or repacking. The effect is that the users have practically all the advantages of a private siding combined with the facility which is provided by a road vehicle of depositing the load exactly where it is required. The idea underlying the container is by no means new, and was suggested as far back as 1811 ; and demountable bodies have been in use among furniture removers, confectioners, and biscuit manufacturers for many years. But it is only since about 1927 that they have come into general use, and have been provided by the railway companies for the general trader. The popularity of the container is evinced by the steady increase in the number of containers provided by the companies. In 1928 the railways had only 350 containers in service ; in 1929 the number rose to over 2,000 and in 1930 to 4,355 ; in 1931 to 6,290, in 1938 to 13,800, and in the early part of 1939 to 15,400.

Traders have found that the container system

of transport has many advantages. There is the direct door-to-door service; packing costs can be reduced; the cost of returning empty cases, casks, crates, or other packaging material is avoided; packing and handling costs, including materials and labour, are reduced; and the risk of pilferage is practically eliminated, since the containers, if necessary, can be locked and sealed. The container system has greatly increased the flexibility of rail transport, because containers can be delivered within the precincts of factories, farms, warehouses, or even on the actual sites where constructional works are in progress. Thus electric cables or drain pipes can be delivered exactly where required, or dressed stone, bricks, or other building materials can be sent direct to the building site. Indeed, containers loaded with building materials are frequently delivered direct from the quarries or brickfields to the upper storeys of partially constructed buildings. They can also be shipped direct from factories in this country to a consignee in France, Holland, Belgium, and other foreign countries.

Traffic which is fragile in nature and likely to be damaged in the course of transhipment between road and rail vehicles is especially suitable for container transit. Some years ago, when containers were a novelty, it was stated, for example, that out of a consignment of 8,400 porcelain pudding-bowls delivered in one container to the store of a well-known firm, none were broken and only ten were cracked. Art treasures, books, museum exhibits, and other

valuable and fragile articles are now frequently moved by containers; for example, 180,000 books were recently transferred from various local sources to the Brotherton Library at Leeds in 350 container loads.

Various types are provided to meet different requirements, and a recent tendency has been the development of specialized containers designed to meet the specific needs of certain kinds of traffic. The most popular type is the ordinary covered container which can carry four tons of goods, though there is also a smaller covered type of 2½-ton capacity, which is largely utilized for groceries, confectionery, paper, boots, and shoes.

For building trade materials, such as bricks, tiles, slates, and stonework, small open containers, some of which are fitted with lids, are available, with a capacity of 1½ to 2½ tons, and these, because of their small size, can be delivered direct by crane to workmen on the upper floors of buildings under construction.

There are also larger open types of 3-ton capacity suitable for carrying stoves, bottles, glass, or grates; while still larger open containers of 4-ton capacity are used for conveying glazed ware, baths, castings, asbestos sheets, or accumulators.

Insulated containers with a capacity of four tons are provided for the conveyance of chilled and frozen meat, fish, and other foodstuffs.

Ventilated containers are available, too, providing good air circulation by being fitted with side

ventilators and roof air extractors; and are employed extensively in connection with fresh meat traffic from Scotland or the West of England to London.

Another special type is the bicycle container, which carries seventy-six cycles, entirely without packing, in two tiers; each bicycle fitting into felted wheel slots. Felted crossbars separate the machines, which require no packing. The fittings are removable, and, when during the off season the cycle business is quiet, the containers can be used for other purposes.

Probably the most unusual type of container is the "AX" unit, which is specially constructed for the carriage of solid carbon dioxide, and insulated by cork to a thickness of ten inches. Loading and unloading is performed through a hatchway in the roof.

In contrast to this highly-specialized type, the containers employed for household removals are a very frequent sight on the railways and the roads. The railway companies now are the largest household removal contractors in the country, but their work is not confined to removals between private houses. They are also prepared to remove whole farms, or even factories, to new sites—lock, stock, and barrel. One such factory removal undertaken for a large engineering works, from Norwich to a new site in the Midlands, involved the transfer of 700 tons of machinery and equipment, together with the household goods of some 150 employees. Another factory removal, from North London to

new premises near Birmingham, involved the dismantling and packing of all the fittings, equipment, and stock. In all, 350 tons were moved, and 111 containers were required for the removal.

A specially interesting removal was that of a Yeovil firm which has been moved to Loughborough, 170 miles away. The firm stipulated that no reduction in output should occur while the removal was being effected, so it was arranged that one-half of the works should maintain full production by means of day- and night-shifts while the other part was being dismantled and removed. When this was re-erected, the second half of the removal was carried out.

In yet another direction the idea of container transit has been developed, and that is in connection with the transport of liquids; special road-rail tanks have been introduced to meet the requirements of firms not connected by private sidings to the railways. These are of two types, the first being demountable tanks which can be transferred between road and rail by means of cranes, and the second are mounted on wheels, and can be hauled by motor tractors between premises of the firms concerned and the railway depots.

On some occasions the very special requirements of certain kinds of traffic are met by utilizing containers. Thus prize delphinium blooms standing in water cans have been successfully carried in an insulated container with the aid of a refrigerant. Dry bulbs kept at an even

temperature of 48 degrees Fahrenheit have been sent by container from Spalding to Penzance, the objective of artificially producing winter conditions being successfully obtained.

The railway companies have found containers a valuable factor in their competition with road transport. Further, they encourage larger direct loads, and the cost of handling is reduced. Traders in return can obtain express transit and the low rates generally applicable to bulk traffic. An extra charge known as a differential is made by the companies, ranging from 5 to 10 per cent. on the rate applicable, but this is offset in many cases by the low rates or even exceptional rates applicable for large lots, and in addition incidental savings as in packing and returned empties may be obtained.

A limitation on the use of containers is imposed by the necessity of having adequate crane power available at the stations. To meet the need the railways are developing the use of mobile cranes. At several large stations in London overhead cranes have been installed to speed up the transfer of containers ; and at one such depot the railway sidings are now so arranged that 130 containers can be changed over between road and rail vehicles without any shunting movements being required.

Chapter IX

RAILWAY FINANCE

The capital required to build and equip a railway is necessarily very considerable. In Great Britain, owing to the high standards of construction adopted, the cost of land, the fact of building through developed areas, and the absence of State subsidies, the capital outlay per route-mile is greater than that in other countries. Another characteristic feature of railway capital is that once the money is spent in building a railway, it becomes fixed and immobilized, and if the railway proves unsuccessful, the capital is almost all entirely lost as the works and equipment cannot well be used for any other purpose. In yet another way, a railway differs in degree from the ordinary type of business enterprise, because the capital required in its construction has to be spent largely without reference to the amount of the traffic. Whether five trains a day or five trains an hour use the line makes little difference to the cost of providing the bridges, tunnels, cuttings, embankments, permanent way, signal-boxes, or other equipment.

The total capital expenditure of the four main-

line railways amounts to the stupendous total of about £1,200,000,000. Of this, nearly 70 per cent. has been spent in providing the permanent way and buildings, while about 13 per cent. has been expended on locomotives and rolling stock. The capital invested in the undertakings is represented by some 19,000 miles of route, 19,600 steam locomotives, nearly 2,000 electric rail-cars, 43,000 passenger vehicles, 646,000 railway-owned freight wagons, 10,200 signal-boxes, 6,700 passenger stations, and 7,000 goods stations.

About 15 per cent. of the total expenditure has been incurred in connection with ancillary enterprises, such as docks, hotels, steamships, houses, or canals. Between them, the four groups own 53 hotels, docks at 76 places, 996 miles of canal, 130 steamships, 50,000 houses, 10,000 motor vehicles, 25,000 horse vehicles, and 11,000 horses. The capital expenditure of the four railway groups amounted to £1,175,000,000 at December 31, 1938, but this exceeded the capital received from stockholders by about £83,000,000. The difference is to be explained by the fact that the excess of expenditure over capital receipts is temporarily met by using various funds held by the companies, such as superannuation funds, savings bank deposits (on which the companies pay interest), or renewal funds.

The amounts charged as capital expenditure are largely based on pre-war prices and first-construction costs, though from year to year amounts are added representing physical im-

provements[1] or additions at the then current prices. The actual form of the accounts is prescribed in detail by various Acts of Parliament; the method adopted under statutory requirement being known as the Double Account system. In the capital account the assets are not written down, but appear therein at cost; no readjustment or revaluation being made. The railway companies have not the legal power to revalue their capital, either upwards or downwards, as have ordinary limited companies. Over seventy years ago, a Royal Commission recommended that Parliament should allow the financial affairs of a railway company to be dealt with under the ordinary law applicable to limited companies, but this recommendation has not yet been adopted.

Actually, the railways could not be replaced at anything like the present value of the capital shown in the accounts. Replacement values based on existing assets, it has been stated before the Railway Wages Board, are about 46 per cent. in excess of the capital expended.

Annual Expenditure.—In order to meet current working expenses such as wages and salaries, fuel, materials, maintenance, and repairs, the railways spent £133,826,000 in 1938. Annual expenditure has risen greatly since 1913, owing to increases in wages and the rise in the price of materials. In 1923 expenditure was about

[1] On replacement at increased cost, the whole is charged to revenue unless there is a betterment, in which case this element is charged to capital.

£157 millions, or more than twice that of 1913. By 1930 it had been reduced to £139 millions, representing a saving of 12 per cent., and reflecting the strenuous efforts which had been made to introduce economies without reducing efficiency. Railway expenditure naturally varies to some extent from year to year with changes in trade activity and price levels, but most of the expenditure is inelastic, so that it is not possible to reduce it in proportion to the fall in receipts.

Railways not Subsidized.—Up to the present, British railways have been self-supporting, meeting all their expenses from their receipts without any subsidy or subvention from the State. In contrast, continental railways have drawn heavily on State subsidies, while in the U.S.A. over one-third of the lines are in the receivers' hands. "In a subsidy-ridden Europe," Lord Stamp emphasized in an address to the Glasgow Chamber of Commerce in February, 1939, "we are the only country which has not taken a penny out of the public pocket for our railway service. We, the trustees of Britain's railways, are proud of this record. For over one hundred years, the railways have been maintained as an economically sound industrial concern. For over one hundred years, profits have been poured back in hundreds of millions of pounds into the business in order to provide the nation with the finest railway transport system, and to offer the maximum degree of efficiency for both the trader and the travelling public."

Even when industry was derated by the Local

Government Act, 1929—though derating applied to the railways—it was laid down that the relief should be transferred to reducing rates for the benefit of the coal, iron, steel, and agricultural industries. "The use of these monies was circumscribed, not only to these industries, but to particular parts, the payments to them being made by way of rebates from railway charges on specific traffics under a carefully compiled schedule, which avoided traffics which were not almost exclusively rail borne. There was thus a striking difference between the State treatment of the two forms of industry, one being permitted to use relief, where it was most needed by it, and the other being required to pay its relief to a fund for distribution in specific directions decided by Parliament." [1]

The Railways (Agreement) Act, 1935, it is also true, enabled the companies to borrow up to £27 millions at a low rate of interest (namely, $2\frac{3}{4}$ per cent.[2]) for the purpose of financing certain new works, but the interest is merely guaranteed, not paid by the Government, and the capital has eventually to be repaid by the companies, which in turn guarantee the Government by the issue of Debenture Stock as cover. The details of the way in which the money was to be applied had to be sanctioned by the Government before the money was raised from the public by the Railway Finance Corporation.

[1] Sir William Wood in a paper read to the Institute of Transport, May, 1936.

[2] This is the net rate including the redemption of the discount on issue.

Railway Revenue.—It is important to distinguish between gross and net revenue. Gross revenue consists of the total annual income from all kinds of traffic, and includes all revenues obtained from the various ancillary enterprises. Net revenues are the total gross receipts, less all working expenses. The proportion of the receipts absorbed by working expenses is known as the "operating ratio." Before the war this was about 65 per cent., but since 1923 it has fluctuated from about 79 per cent. to about 83 per cent., except in 1926, when it was 90 per cent. The operating ratio gives a useful measure of railway financial efficiency, though it must be used with care. If wages or material costs rise without a corresponding increase in rates and fares, the operating ratio will increase. If it exceeds 100 per cent. expenditure is actually exceeding receipts, but if it is below 100 per cent. it does not necessarily mean that dividends can be paid, because the volume of traffic may be too small to allow of much of a surplus being earned.

The net revenue, if any, which remains after providing for working expenses and meeting interest on loans and debentures is available for paying dividends to the stockholders, less any amounts placed to reserve.

The Railways Act, 1921, limited the annual net revenues that might be earned by the four groups to approximately £50 millions. This standard revenue was based on 1913 revenues, but minor adjustments are made from year to year to provide for the remuneration of additional capital

expenditure. If earned, the standard revenue would yield about 4.7 per cent. on the capital receipts of the companies. Actually in no year since 1928, when the rate-fixing sections of the Act became operative, have the net revenues earned been anywhere near the standard revenue. In the best year since then, namely, 1929, the deficit was £5.4 millions, and in 1938 it was £22.4 millions. The Railway Rates Tribunal in its annual reviews of standard and exceptional charges has stated clearly and repeatedly that the deficiencies are not due to any lack of efficiency and economy in management. They are to be explained by numerous factors such as road competition and trade depression, especially in the export industries.

In 1937 the railway companies were authorized by the Railway Rates Tribunal to increase their charges by 5 per cent. as from 1st October in order to bring railway revenues nearer to the standard revenue. This was the only occasion on which the Tribunal revised charges to reduce the deficiency in standard revenue.

In the past railway stocks were greatly favoured by small investors, and they were recognized by law as trustee securities. Their popularity was due to the steady dividends, the wide market available which ensured ready sale at short notice, and the fact that the stocks were easily split up into small amounts. Even to-day, the total number of railway stockholders is very large, being in the region of 850,000, and of these more than half hold stock of only £500 or under

in nominal value (the current stock-exchange value would be very much lower.) Some holders may, of course, hold stock in several companies, but, on the other hand, many large investments, such as those of insurance companies, friendly societies, building societies, or fixed trusts, represent a large number of small investors.

Railway stocks are of different types, according to the priority in payment of dividend. First there are debenture stocks, which bear a fixed rate of interest but have no other claim except that in the event of default in interest payment the holders may appoint a receiver to work the line for their benefit until all arrears are paid off, though they cannot seize and dispose of the assets to redeem their capital. There are also a few mortgage loans and redeemable debenture stock. Next come the guaranteed and preference stocks, and these have a prior claim to a fixed dividend before anything is paid on ordinary stocks. The ordinary stockholder bears the greatest risk, but his dividend is not restricted in amount, though in fact railway stock has never paid high dividends comparable to those earned by successful enterprises in other industries. In 1938 only the Southern Railway and the G.W.R. were able to pay dividends on their ordinary stocks; the former paying 5 per cent. on its preferred ordinary and the latter 10s. per cent. on its ordinary stock.

It is frequently asserted that railway capital should be drastically pruned so that it would bear a closer relation to actual earning powers. Any change in the nominal capital, however,

would not affect the earning power of the capital, unless the prior stocks are reduced in value, when the gain would be transferred to the ordinary stockholder. As Sir William Wood has stated, "The only advantage of recapitalization is the theoretical one that writing down will attract new capital. This is sound where a limited company for domestic reasons rearranges its capital, but I have never heard of a case in this country where this was done, and there was a simultaneous restriction by Parliament of future profits. It is not the course I would suggest to secure subscribers to new capital issues." [1] He concluded that proposals for writing down railway capital are meaningless if they merely alter capital labels, and that they are simply confiscation if based on stabilization of present earning power or stock exchange quotations.

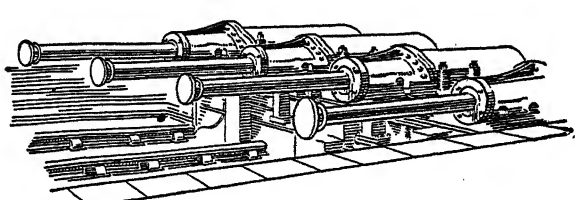
"Suggestions sometimes made," he said, "that because of the present depression of net revenue, there should be a reduction of their low maximum earning power permissible in ideal conditions, are as unsound as they are unfair."

The argument in favour of recapitalization is sometimes based on the thesis that railway capital has been "watered" in the past, that is, its nominal value has been inflated either by the high prices paid for land and easements, or by the creation of bonus stock, but against this it is pointed out that the replacement value of the actual assets of the companies far exceeds the

[1] Sir William Wood, Presidential Address to the Railway Students' Association, 1933.

nominal capital, and bonus or nominal additions are not included in capital account. The nominal value of the stocks issued is £1,102,000,000, and the capital receipts are £1,093,000,000.

In conclusion, it can fairly be stated that the railways still remain the backbone of inland transport facilities in Great Britain, despite the progress made by road motor transport. They provide a complete national system of transport penetrating to all parts of the country, providing not only movement services by land, sea, and air, but also warehousing, storage, dock, hotel, and numerous other services. Each year they carry more than one thousand million passengers, more than 160 million tons of coal, 45 million tons of other minerals, and 42 million tons of merchandise, 90 million parcels, and 8 million head of livestock. This they do with so outstanding a record of safe travel that, it has been said, the safest place in the world is in a railway train.



APPENDIX

Some Facts about British Railways

(Year 1938; Main Line Companies—unless otherwise stated)

The Permanent Way and Works

Route mileage (all railways)	20,000 miles
Four main line companies	19,000 „
Total mileage (all railways) reduced to single track and including sidings	52,000 „

Practically all the mileage is of standard gauge (4 ft. 8½ in.), as there are now less than 100 route miles of narrow-gauge railways.

Electrified lines (four main line companies), 800 route miles.

London Passenger Transport Board railways (electrified), 125 route miles.

Weight of rail (main line standard) per yard	95 lb.
Weight of chair (standard)	46 lb.
Length of rail (standard)	60 ft.
Sleepers per mile	2,112
Signal-boxes	10,220
Passenger stations	6,698

Goods stations	6,908
Water troughs	141
Tunnels	1,050

The longest tunnel is that under the Severn (4 miles 628 yards long), while three others—Totley, Standedge, and Woodhead—are over three miles long. The highest altitude reached by the rails is 1,484 ft., between Dalnaspidal and Dalwhinnie.

Locomotives and Rolling Stock

Steam locomotives	19,577
Diesel-oil locomotives [1]	35
Steam rail-cars	86
Diesel-oil rail-cars [1]	28
Electric motor cars	1,888
Passenger carriages	42,575
Passenger carriages (seating capacity)	2,513,000
Luggage, parcel, and other vans	6,316
Fish vans and trucks	5,445
Horse-boxes	3,209
Post office vans	165
Freight wagons (railway-owned)	646,479
Freight wagons (private-owners)—Year 1937	637,670

Of the private owners' wagons 592,498 were coal and coke wagons and 13,457 tank wagons.

Containers (year 1939)	15,521
Motor vehicles ,,	10,367
Horses ,,	11,163
Horse vehicles ,,	24,823

[1] These have increased considerably in number since 1938.

APPENDIX

Volume of Traffic

Passenger Journeys.					
	L.M.S.R. Millions.	L.N.E.R. Millions.	G.W.R. Millions.	S.R. Millions.	Total. Millions.
Season ticket	119.6	81.3	36.2	132.4	369.2
Others . .	290.7	180.5	92.0	225.9	789.1
Total, 1938 .	410.3	261.7	128.2	358.3	1158.3
Total, 1937 .	435.0	277.9	137.0	365.8	1215.6

Average receipt per passenger 3rd class (excluding season tickets and workmen's tickets) :

L.M.S.R.	1s. 5.43d.
L.N.E.R.	1s. 3.42d.
G.W.R.	1s. 9.02d.
S.R.	1s. 1.60d.

Goods and Mineral Traffic. (Million Tons.)					
	L.M.S.R.	L.N.E.R.	G.W.R.	S.R.	Total.
Merchandise (Class 7–21)	16.6	14.7	8.3	2.9	42.5
Minerals and merchandise (Class 1–6)	20.4	17.9	6.3	1.3	45.9
Coal, coke, and patent fuel . .	59.4	68.9	34.7	3.1	166.1
Total, 1938 . .	96.4	101.5	49.3	7.3	244.5
Total, 1937 . .	107.7	114.8	56.3	7.9	286.7

APPENDIX

LIVESTOCK (Rail-borne).
(Million Head.)

	L.M.S.R.	L.N.E.R.	G.W.R.	S.R.	Total.
1938	3.9	2.8	1.3	0.4	8.4
1937	4.1	3.0	1.5	0.5	9.1

	£
Railway net receipts . . .	25,883,000
Joint lines (net)	998,000
Ancillary enterprises (net)—docks, hotels, steamboats, etc. . .	637,000
Miscellaneous (net) . . .	1,466,000
Total Net Revenue .	28,984,000

RAILWAY NET REVENUES.
(£ million.)

Year.	Net Revenue.	Deficiency against Standard Revenue for Year.
1928	41.0	9.0
1929	45.0	5.4
1930	37.7	13.1
1931	35.1	15.8
1932	28.7	22.4
1933	31.0	20.3
1934	33.7	17.6
1935	34.0	17.3
1936	35.7	15.7
1937	37.9	13.5
1938	29.9	22.4

REVENUE AND EXPENDITURE, 1938

Railway Revenue :

	£
Passengers :	
Ordinary	45,088,000
Season tickets	7,973,000
Workmen's tickets	3,464,000
Parcels	16,351,000
Merchandise	39,068,000
Minerals	12,012,000
Coal	33,012,000
Livestock	1,168,000
Miscellaneous	1,573,000
Total	159,709,000

Railway Expenditure :

	£
Maintenance :	
Way and works	20,644,000
Rolling stock	23,554,000
Loco. running expenses	33,668,000
Traffic expenses	45,745,000
General charges	5,200,000
Rates	2,930,000
National insurance	1,344,000
Miscellaneous	741,000
Total	133,826,000

APPENDIX

Railway Staff:

Total Number, 581,401.

Includes 70,000 clerks, 35,500 drivers and motor-men, 33,500 firemen, 56,000 permanent-way men, 117,000 workshop staff, 36,500 porters, 16,500 shunters, and 23,500 signalmen. The amount paid in salaries and wages per annum is £104 million.

SOME SUGGESTIONS FOR FURTHER READING

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